

Group assignment - CS-E5220

User Interface Construction

Members

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1. Introduction

For the group assignment, the topic of applying for a government ID was further developed using previous researches done for the individual assignment. During the development of the User Interface, it has been considered that Namibia's citizens have limited experience with technology and only have access to a communal smartphone and the Internet. For this reason, the UI has been only developed for small screen sizes, and it provides a very straightforward way to interact with.

2. Technologies

The following technologies have been used to create the prototype:

1. Angular
2. Firebase: Firebase has been used as a host for our prototype
3. Nodejs
4. Bootstrap 4



Figure 1: Technologies' icons

2.1 Angular

Angular is a framework made to help you build modern applications for the web, mobile, or desktop, backed by Google.

The reasons to use Angular, a real framework, instead of others prototyping tools are the following:

1. Show a fully working prototype, including access to the documents of the phone, error handling, form validation, feedback, in order to offer a real User-Experience to the testers.
2. Offer a website with a responsive nature to create a feeling of testing a final product.
3. Allowing typing in all the inputs and showing it at the end of the form to provide real feedback to the tester and avoiding static mockups.

2.2 Bootstrap 4

Bootstrap library is the world's most popular framework for building responsive, mobile-first sites. It is an open source toolkit for developing with HTML, CSS, and JS, and its aim is to quickly prototype your ideas.

Bootstrap 4 provides to the website the consistency that requires. Following this library, all the elements of the UI have a specific pattern (colors, sizes, padding, margins, etc...). To be more exact and accurate, the theme that has been selected is "Bootswatch Materia". Extra information about this theme is available here <https://bootswatch.com/materia>. The link contains information about the colors, elements, typography, progress bar, and all the other main elements of a web page.

2.2.1 Color palette

Bootstrap colors with a handful of color utility classes. Includes support for styling links with hover states, too. The ones that have been used in our prototype are the ones shown in the following Figure.



Figure 2: Color Palette

3 Design

3.1 Procedure

Since there is not a unique established process for designing, this document follows the five-stage Design Thinking model proposed by the Hasso-Plattner Institute of Design at Stanford (d.school) shown in the next figure. This process is divided into 5 stages:

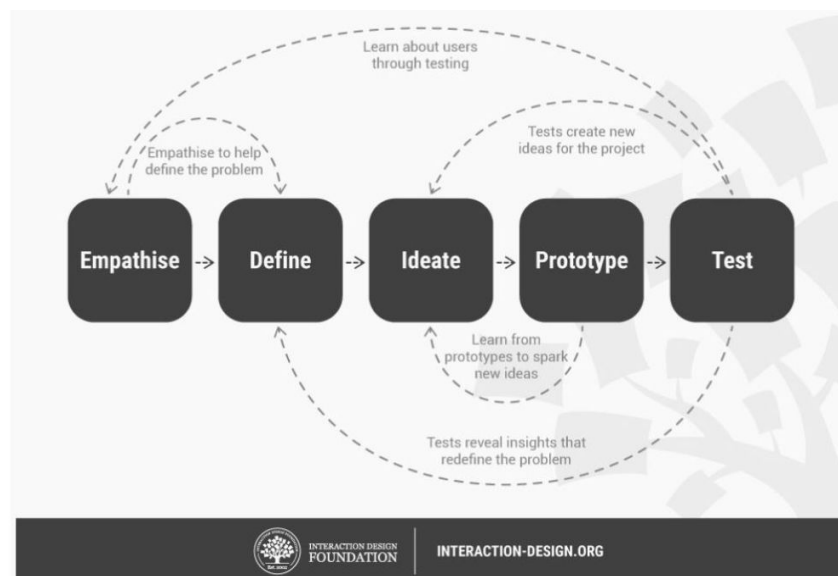


Figure 3: Source: <https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process>

1. Empathise: Understand to potentials users and their needs in the real world.
2. Define: Use this needs to identify and define problems where you could focus on.
3. Ideate: Generate options to solve the problems identified during the previous step.
4. Prototype: Create a simple experience through the previous options.
5. Test: Examine your prototype.

One important fact is that this process is iterative determining that it could be iterated as many times as it requires.

Since it was not possible to test the application with people from Namibia, the tests have been done by students of Aalto University trying to reach non-expert users.

3.2 Patterns

3.2.1 Design patterns

According to [UI-PATTERNS.COM](https://ui-patterns.com) our web application follows few design patterns split into two groups:

1. Getting input
 - a. Input feedback (in any input of the form)
 - b. Calendar picker (to select birth date)
 - c. Structured format (date using calendar picker)
 - d. Fill in the blanks (Eye Color)
2. Navigation
 - a. Shortcut Dropdown
 - b. Modal (Data preview after selecting a menu option or completing the form)
 - c. Cognition
 - i. The illusion of control through back/proceed buttons

3.2.2 Architectural pattern

Angular is a component based MVC (Model-View-Controller) framework. The key idea behind an Angular project are the components. Each of these components is a highly reusable and independent cohesive block of code split into a view, its logic or controller and the required data (model). The components architecture provides the capability of maintenance without affecting the other components.

3.3 Wireframe

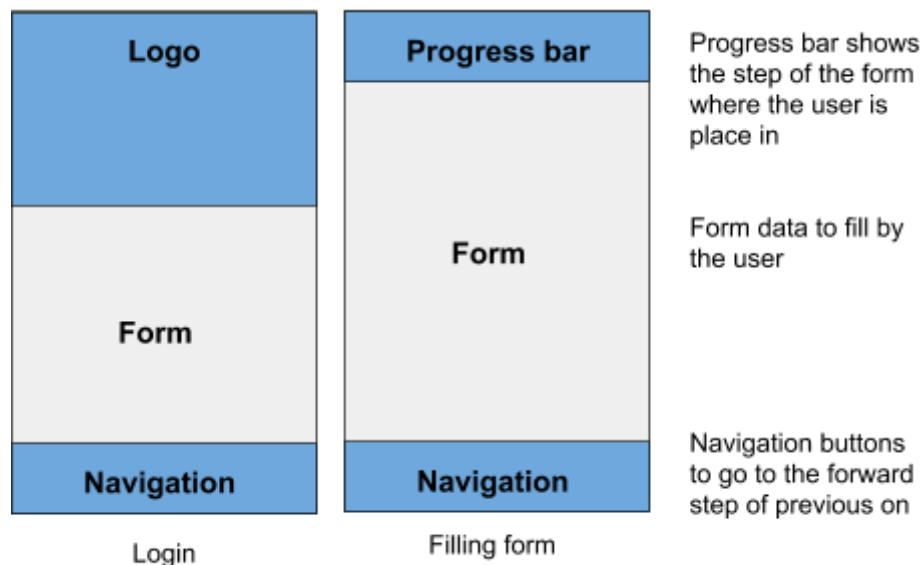


Figure 4: Main wireframe of the web application

4 Guidelines review

This section provides a complete overview of all the guidelines implemented in the developed application; it also provides real-case examples for most of the guidelines.

4.1 Shneiderman's 8 Golden Rules

1. Strive for consistency
 - Forward and Back buttons are always displayed in the same order and following the same style (colors, sizes, paddings...)
 - Size and colors or the letters are consistent throughout the application.
2. Enable frequent users to use shortcuts
 - Applying for an official ID is not a frequently repeated action for an individual user, however, applying for duplicate ID skips the form, which could be considered as a shortcut
3. Offer informative feedback
 - After filling out the form, an overview of the information is provided
4. Design dialogue to yield closure
 - The last page thanks to the user for completing the form and provides information on where and when to pick up the ID
5. Offer simple error handling
 - In case the input is missing, the user is prevented from continuing with the application until he/she inserts the required piece of information.
6. Permit easy reversal of actions

- After uploading a document there is an option to delete it or replace it with another one.
 - The back button allows to easily come back to the previous step to modify the data
7. Support internal locus of control
- The user can freely navigate through the steps of the form - after filling in the required data without the need to submit anything.
8. Reduce short-term memory load
- The user is guided during the process in a simple step by step fashion; each step does not require much information and it is also always possible to re-check every step.

4.2 Nielsen's Ten Heuristics

1. Visibility of system status

- Progress bar showing the current step and number of remaining ones appears throughout the form
- The final page shows to the user a message reminding that the progress has been finished
- When the process of uploading a file in the last section of the form is finished, the name of the document is shown, providing feedback about the status to the user. Same happens when the file is deleted from the database after clicking on the delete icon.

2. Match between system and the real world

- The use case selection is a metaphor to a take-a-number machine equipped with a touchscreen with several options that are common in government offices
- The use case selection follows the same order than the official government page and content of the form is also the same
- Inputs allow the user to upload specific formats. For example, for documents allows to upload “.pdf”, “.png” and “.jpg”, but for the ID photo only “.jpg” and “.png”
- URLs of the webpage shows the name of the operation and step that the user is doing at any moment
- Icons try to follow a real pattern. For example, a bin icon would mean to remove a field

3. User control and freedom

- The user can go forward or come back to the previous step during the whole process to update the data of the form.
- Being a Web application as it is, the user could close the tab in the phone to finish the procedure at any moment.

4. Consistency and standards

- Widely known design patterns such as date picker or file selection are used
- Bootstrap 4 provides a standardized style in the whole application.

5. Error prevention

- The form prevent the user to make errors during the process such as writing letters in the postal code, incorrect lengths, or leaving mandatory inputs empty.

6. Recognition rather than recall

- Placeholders show the desired data format so the user does not have to guess

7. Flexibility and efficiency of use

- The application supports several use cases such as applying for a first ID or a replacement for an old one. For the required documentation, it has been followed the model that official Namibia's government provides.

8. Aesthetics and minimalist design

- The application has a clean conservative design appropriate for official usage that only uses few selected colors

9. Help users recognize, diagnose and recover from errors

- The error messages appear close to the relevant field and contain an understandable guidance
- The documents to upload are only shown to the user who actually needs it. For example, the marriage certificate is shown if the user is a woman and she is married. In any other case, the document does not appear
- All the mandatory inputs have been set up as required, not allowing to the user to skip them.

10. Help and documentation

- All of the use cases are clearly explained and a list of required documents is provided before going on with the form

4.3 Smith & Mosier

Some of the guidelines about Data Entry were not applicable to the prototype; however, most of them were still implemented. The not applicable guidelines were those related to printing (it is assumed that no printer is available), cursor display (since the web application was optimized only for a smartphone no cursor is present) and all the one related to any kind of keyboard shortcut.

Since the application is mainly a form, most of the Data Display guidelines are not applicable and thus, not implemented; besides, bootstrap already implements most of the design principles.

Finally, most of the sequence control guidelines were used; the application minimalizes the users' actions (3.0/2), that only has to insert data and press a button and provides help where applicable. Besides, the application requires that the user starts the process (3.0/4) and it proceeds only by an explicit action of the user (3.0/5); these actions are consistent throughout the various screens of the application (3.0/6).

4.4 WCAG 2

Since the application comes in the form of a web application, some accessibility guidelines were also enforced. WCAG 2 divides the guidelines into four main Principles:

- Principle 1: Perceivable
- Principle 2: Operable
- Principle 3: Understandable
- Principle 4: Robust

Each Principle categorizes its guidelines with different Conformance Levels; for example, to achieve the conformance level of AAA a website must implement all the guidelines of levels AAA, AA and A.

Tenot.io website was used to automatically evaluate compliance with these guidelines; the Figure below provides an example of the generated report for the analysis.

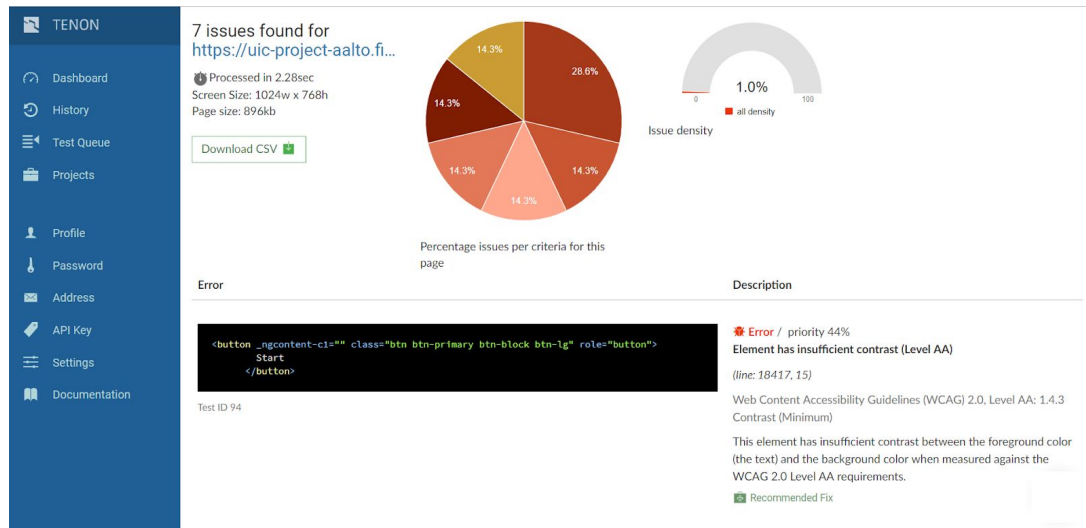


Figure 5: Tenon.io feedback

5 Copyrights

We do not expect to run into any copyright issues as we are creating everything ourselves. The only thing we may need to copyright is if we use special icons or fonts:

- The license of the used font in the project can be found at https://drive.google.com/open?id=15zSy78KuO9bV2WrRvhWt_4oVybidisvy
- Regarding the icons, the selected ones come from FontAwesome (<https://fontawesome.com>) that provides free icons. Semantic Icons are those used to convey meaning, rather than just pure decoration. This includes icons without text next to them used as interactive controls — buttons, form elements, toggles, etc... to the largest amount of people possible
- For the web page is going to have a permissive free software license. Searching into all this kind of license, we get up to use the MIT license from the Massachusetts Institute of Technology. The reason that we choose this license because of the popularity and all the advantage and permission were given to the project

6. Flowchart

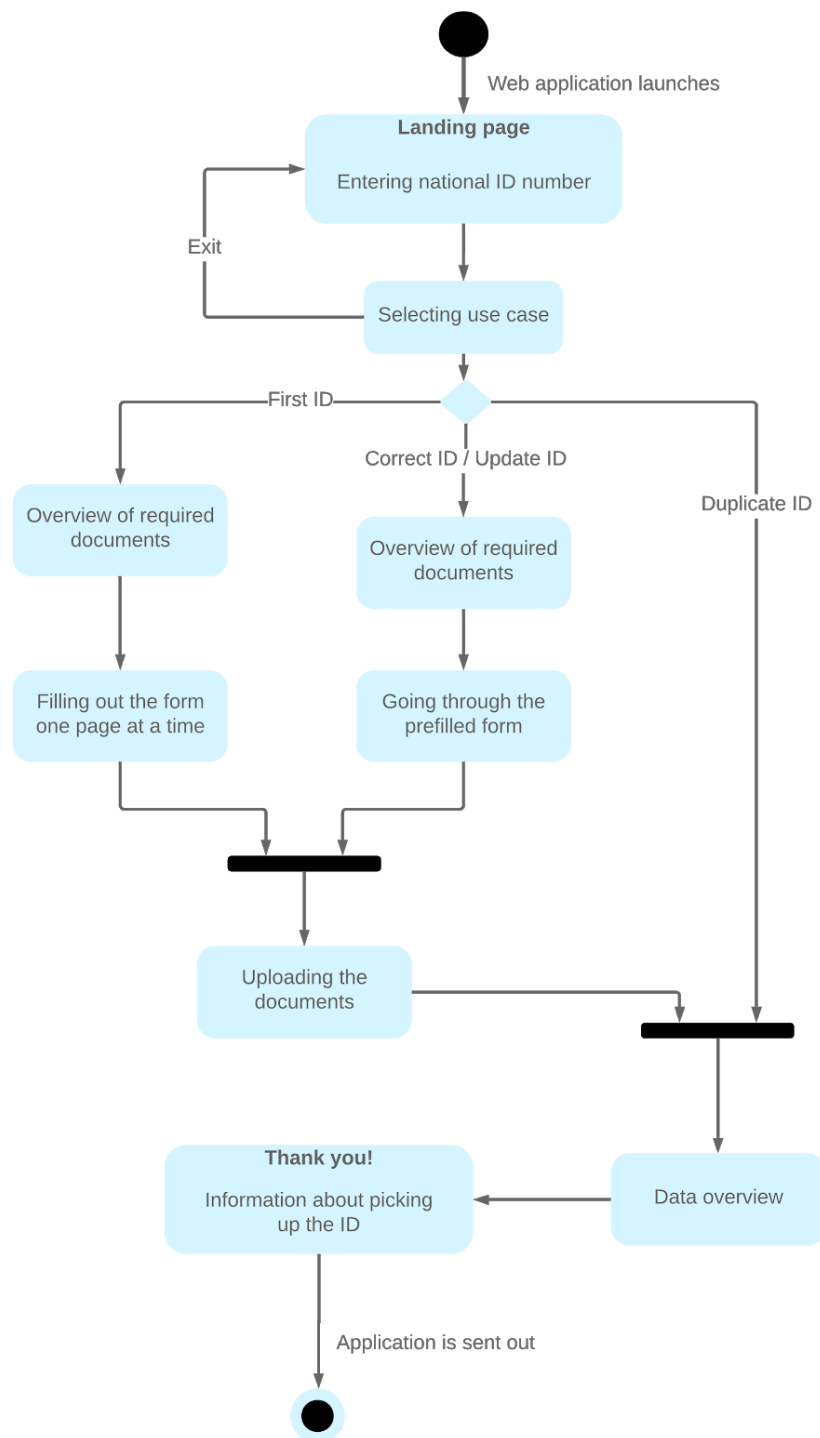


Figure 6: Flowchart of the application

7. Solution

The implemented solution allows the citizen to visit the government office only once while preserving the needed level of security. Indeed, to prevent identity theft and to eliminate the risk of document falsification, the applicant's identity has to be verified. Additionally, the collection of fingerprints is not feasible by using a smartphone even if it has a built-in fingerprint sensor as those collect a number of partial fingerprint scans which cannot be converted into one complete imprint to be used by the government authorities.

The selected platform is a web application because as it can be easily linked to from the existing government website and does not require the user to install a native app, which would represent an unnecessary barrier, especially for an inexperienced user. Besides, a web application makes much more sense since the process is typically done only once in a long period of time. It is also easy to keep it updated and the website is easily accessible with a browser. The application was developed with a mobile-first approach because smartphones will be the most commonly used platform; however, the application also allows access from laptops. Finally, a web application provides the developer with the freedom to update it without the intervention of the users and the ability to develop a single software for all the operating systems.

Since a crucial requirement was to realistically simulate users interaction, including the text input, which is not supported in Figma or similar tools, the website is implemented using Angular, a Javascript framework. Axure RP was another possibility taken into account, but instead, Angular was chosen to learn a new tool.

The primary interaction style is a form fill-in; the form uses the same entries as the existing paper form, except those that can be automated by digitizing the process (namely the Date of entry, Application number and Office number).

As the device used to fill out the form is typically going to be shared, an overview of the necessary information is provided once the application has been completed. The application displays where and when is possible to pick up the ID. There are no notifications reminding the users to pick up their ID as there is no reliable way to contact them once they no longer have access to the communal device.

7.1 Prototype

The final prototype presents a clean, simple and modern layout where the user is continuously getting feedback during the procedure. The web application is divided into three main tasks:

1. Login: access to the application
2. Menu: selecting the required operation
3. Form: filling the required information and set up the appointment

The web application is available at <https://uic-project-aalto.firebaseio.com>. Since it is only a prototype, not all the possible combinations are implemented. Besides, it is optimized only for smartphones, since it is the only available device. For this reason, to test the application it is advisable to use the Device Toolbar (**ctrl + shift + m**) in the Chrome's console. The minimum resolution that the designing team has been able to work with has been the iPhone's 5 (2012) resolution. In a smaller resolution than the previously mentioned the behavior of the web application is not optimal.

Related information:

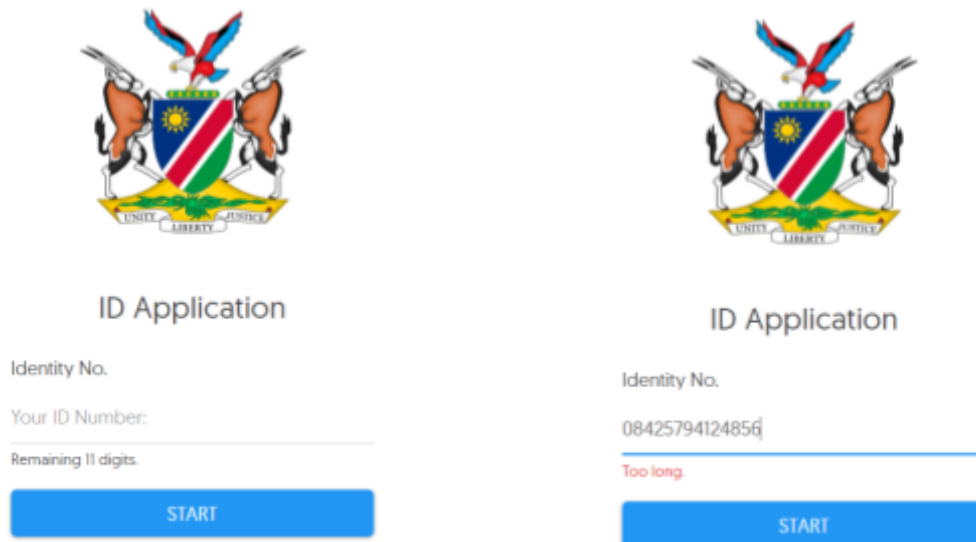
- The code that has been developed during this assignment can be found at <https://github.com/MarioLopezBatres/uic-id-application>
- An example video of the web application can be found in the next https://drive.google.com/file/d/1z_5fVUq6oeW773CSCNi93XxDT6vsElbH/view

In the following subsections, the related views to these tasks are shown.

7.1.1 Login

The system requires a really simple login information. Since the final requirement to get your ID is to prove your identity at the government office through his fingerprints, the designing team decided that it was not required a lot of security in the login phase.

The user must introduce his identity number. The system provides continuous feedback during this action showing the remaining digits or when the number is too long.



The figure displays two side-by-side screenshots of a web application titled "ID Application". Both screenshots feature the national coat of arms of Mexico at the top. The left screenshot shows the login form with the following elements: "Identity No." label, "Your ID Number:" label, an empty input field, "Remaining 11 digits." text, and a blue "START" button. The right screenshot shows the same form after a user has entered a number. The input field now contains "08425794124856". Below the input field, the text "Too long" is displayed in red. The "START" button remains blue.

Figure 7: Screenshots of the login page

7.1.2 Menu

The next action to be done is to select the operation that he wants to realize.

The prototype shows 2 possible scenarios at the same time in order to show an easy-to-check User Interface. The first one is “FIRST ID”, where a new user creates for the first time his ID. In this case, the other buttons (CORRECT ID, UPDATE ID, DUPLICATE ID) should be hidden. On the other hand, if a user has already created an ID or has previously stored data, the system contains their data and will hide the “FIRST ID” option.

After selecting any of the options, the user would get a reminder about the documentation that he would need during the process.

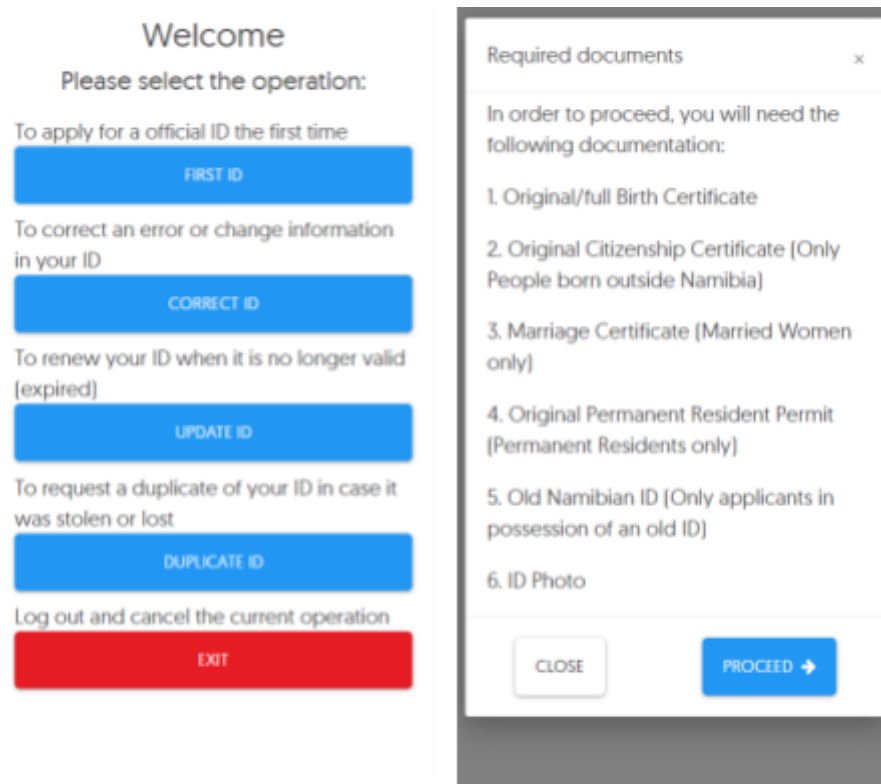


Figure 8: Screenshots of the menu

7.1.3 Form

The final mandatory task to be realized by the user would be the introducing the data in the system.

1. If the user is new in the system and he is creating a new ID, all the required fields should be filled.
2. On the other hand, if the user has some information in the system, his task would be to update the brought data by the system in order to get the updated or correct ID

- The last option would be to duplicate an ID. In order to duplicate it the user does not need to update or introduce any data.

In all of the operations, the user is guided by the system in order to avoid any kind of error (input validation).

Furthermore, a progress bar continuously shows to the user in which step of the form is placed.

The figure displays two side-by-side screenshots of a web form titled 'Personal data'. Both screenshots feature a progress bar at the top indicating '1/5' steps. Below the title, a note states 'Fields marked with * are mandatory.'

Left Screenshot: First ID - Introduce new data

- Full First name(s) ***: Input field with placeholder text 'e.g. Mario' and a red error message 'Please insert your full name.'
- Present legitimate surname ***: Input field with placeholder text 'e.g. Lopez' and a red error message 'Please insert your surname.'
- Marital Status ***: Radio button group with four options: Single (selected), Married, Widowed, and Divorced.
- Navigation**: 'GO BACK' button with a left arrow and 'PROCEED' button with a right arrow.

Right Screenshot: Update/Correct - Update data

- Full First name(s) ***: Input field containing the text 'Sackaria'.
- Present legitimate surname ***: Input field containing the text 'Ellina'.
- Marital Status ***: Radio button group with four options: Single (selected), Married, Widowed, and Divorced.
- Navigation**: 'GO BACK' button with a left arrow and 'PROCEED' button with a right arrow.

Figure 9: Screenshots of the form

Appendix 1 - Screenshots of the application

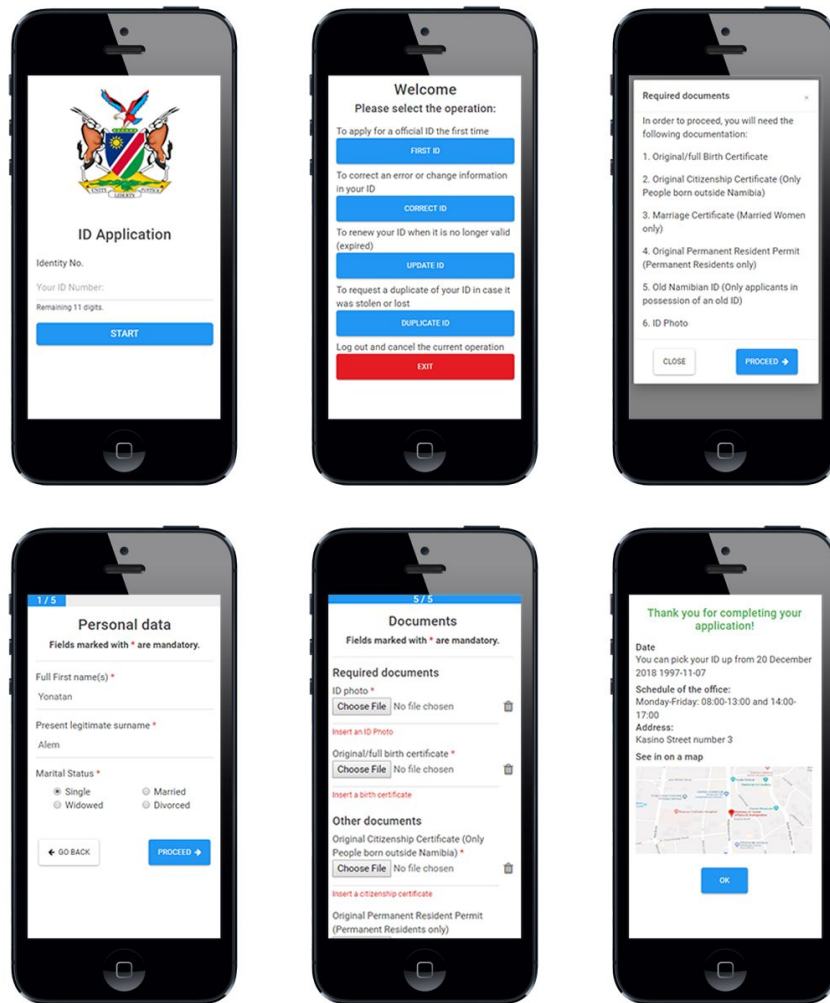


Figure 8: Screenshots of the application

8. References

Shneiderman's and Nielsen's guidelines extracted from the Course slides.

Smith & Mosier guidelines (1986). GUIDELINES FOR DESIGNING USER INTERFACE SOFTWARE. <http://hcibib.org/sam/index.html>

Smith & Mosier guidelines (1986). Data entry - <http://hcibib.org/sam/1.html>

Smith & Mosier guidelines (1986). Date display - <http://hcibib.org/sam/2.html>

Smith & Mosier guidelines (1986). Sequence control - <http://hcibib.org/sam/3.html>

WCAG 2 (2008). Web Content Accessibility Guidelines (WCAG) 2.0.

<https://www.w3.org/TR/WCAG20/>

Stanford design thinking process:

<https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process>

Logos of the technologies used from their respective websites

All the remaining images are created by our group.