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Human Computer Interaction
Expire Guard
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Natalia Maria Mucha

Antonio Ciprani

Giuseppe Valente

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1 Introduction

In today's fast-paced and compliance-driven world, managing the expiration dates of important documents can be a daunting task. From business contracts to certifications, permits, and personal identification documents, ensuring that these crucial papers are up-to-date is essential for smooth operations and avoiding legal pitfalls. Introducing **Expire Guard**, the ultimate solution for managing document expiration.

- **Automated Alerts and Notifications:** Receive timely reminders via email, push notifications or SMS before your documents reach their expiration dates, allowing you ample time to renew or replace them.
- **Centralized Document Repository:** Store and organize all your important documents in a secure, cloud-based environment, ensuring easy access and management.
- **Customizable Expiration Tracking:** Tailor the tracking system to suit your specific needs, whether it's for personal documents, business contracts, or regulatory compliance.
- **Advanced Search and Filter Options:** Quickly locate documents using advanced search features and filters, making document management efficient and hassle-free.
- **Add documents using the phone camera:** Using the phone camera create PDF documents add manage it with the notification system.
- **Set notifications on files on your phone:** Manage the files on your phone and add them the notification.

2 Requirement Analysis

This phase is crucial for developing a user-centered application like Expire Guard. It involves understanding the users' needs, goals, and tasks to ensure that Expire Guard's design and functionality align with their expectations and provide an optimal user experience.

2.1 Competitor Analysis

We have identified two main competitors that can be compared to Expire Guard. The first competitor is Google Calendar, a widely used application that allows users to create and manage events. Although it is not specifically designed to store and track document expiration dates, users can utilize it for this purpose by creating an event on the relevant date and time. Google Calendar's intuitive interface and integration with other Google services make it a versatile tool for managing schedules and reminders.

The second competitor is Evernote, a note-taking application that allows users to capture ideas, create to-do lists, and schedule memos. Evernote enables users to set alert triggers to notify them of their created memos, enhancing productivity and organization. While Evernote is primarily used for note-taking, its flexible tagging and search functionalities can be adapted for tracking document-related information, including expiration dates.

The following tables present a detailed comparison between Expire Guard and its competitors:

Element of Comparison	Expire Guard	Google Calendar
Audience	Aimed at everyone with access to a smartphone and basic knowledge of it.	Aimed at everyone with access to a smartphone and basic knowledge of it.
Document storage	Users can store and organize all their important documents in a secure, cloud-based environment, ensuring easy access and management.	Difficult to distinguish between generic events and events related to documents.
Document scan	Users can add a scan of the document.	Not supported.
Expiration Tracking	Users can create a customized tracking system that reminds them of the expiration dates of documents with different alert periods, suiting their specific needs for different types of documents.	Users must manually decide the date in which to create an event to remind them of the expiration of a document.
Communication with the Users	Users are presented with an intuitive UI that guides them in the process of adding and tracking a document.	Simple calendar UI, easy to understand and well documented, simple event creation process.
Feedback to the User	When the User adds a new document and tracking gets notified in the UI of the successful operation alongside with an email. When an alert period is triggered, the User receives a notify on the smartphone and an email to their preferred email address.	When an event is added, the User receives an email to notify them of the new event. When the event approaches, the User is reminded of it with an email.
Subscription	Free unlimited features.	Free unlimited features.

Table 1: Comparison between Expire Guard and Google Calendar

Element of Comparison	Expire Guard	Evernote
Audience	Aimed at everyone with access to a smartphone and basic knowledge of it.	Aimed at young students with more than common tech and smartphone knowledge.
Document storage	Users can store and organize all their important documents in a secure, cloud-based environment, ensuring easy access and management.	Difficult to distinguish between generic memos and memos related to documents.
Document scan	Users can add a scan of the document	Users can add pictures alongside their memos
Expiration Tracking	Users can create a customized tracking system that reminds them of the expiration dates of documents with different alert periods, suiting their specific needs for different types of documents.	Users must manually decide the date in which they will be reminded of the memo about the document expiration.
Communication with the Users	Users are presented with an intuitive UI that guides them in to the process of adding and tracking a document.	More complex and structured UI, not so easy to understand but fairly intuitive, tracked and well defined memo creation process.
Feedback to the User	When the User adds a new document and tracking gets notified in the UI of the successful operation alongside with an email. When an alert period is triggered, the User receives a notify on the smartphone and an email con their preferred email address.	When a memo is added the User receives confirmation in the UI, when the memo reaches the alert period the User receives an email and a smartphone notify.
Subscription	Free unlimited features.	Very limited free features, multiple subscription tears to enhance them.

Table 2: Comparison between Expire Guard and Evernote

Both comparisons demonstrate that our approach, focused on storing and tracking document expiration dates, is more effective in achieving the specific goal of notifying users about upcoming expirations based on their preferences. While Google Calendar and Evernote offer versatile functionalities, they cater to broader user needs beyond document expiration tracking. Our solution simplifies and enhances this process, making it more

tailored and efficient compared to using Google Calendar or Evernote for this specific purpose.

2.2 User Analysis

The target users of this application are individuals with demanding jobs that require them to manage numerous document expiration dates, such as driver's licenses, legal documents, taxes, and more. The target profile is outlined as follows:

AGE	18 - 50
GENDER	Female/Male
REGION	Europe Union
TECHNOLOGY	Mobile applications/Smartphone
EDUCATION	Any

The next step is to define several personas and their corresponding scenarios. Personas are fictional characters created in user-centered design to embody the types of users who would have a genuine interest in using the application daily. They serve a pivotal role in uncovering insights about the audience, particularly representative of working professionals in the European Union.

Once personas are established, defining user scenarios becomes essential for a deeper understanding of each user's needs. These scenarios are narrative stories crafted to analyze how users would interact with and benefit from the application in various situations.

In the following subsection, three distinct personas will be presented, accompanied by a scenario for each. These scenarios are instrumental in advancing the user analysis and informing the application's development process.

2.2.1 First persona: Alex



Alex is the visionary founder and CEO of InnovateX Solutions, a cutting-edge startup focused on developing innovative tech products. With a background in engineering and business, Alex has led the company from a small team to a rapidly growing enterprise. Known for his strategic thinking and leadership, he is dedicated to driving growth, fostering innovation, and ensuring the company remains at the forefront of the tech industry. Alex needs an application to manage document expirations effectively across various departments. This includes tracking and receiving reminders for critical documents such as: Business licenses, Employee ID cards, Contracts and agreements, Financial documents, Product certifications.

2.2.2 Second persona: Emily

Emily is a seasoned HR Manager with over 10 years of experience in the human resources field. She is currently working at an innovation company. Emily is responsible for managing employee relations, recruitment, compliance, and ensuring that all HR policies are effectively implemented. She is passionate about fostering a positive workplace culture and is dedicated to the professional growth and well-being of her team. Emily needs an application to manage document expirations efficiently. This includes tracking and receiving reminders for various important documents such as: Employee ID cards, Driver's licenses, Work permits, Professional certifications, Company insurance documents. Emily is actively looking for a solution that can address these needs and help her manage the document expirations seamlessly, allowing her to focus more on employee development and organizational growth.



2.2.3 Third persona: David



David is a skilled IT Engineer with over 15 years of experience in the technology sector. He is currently employed a fast-growing tech company that specializes in innovative software solutions. David's role involves managing IT infrastructure, ensuring network security, and supporting the technical needs of the company. He is known for his problem-solving skills and his ability to implement efficient tech solutions. David needs an application to manage document expirations effectively. This includes tracking and receiving reminders for various important documents such as:Employee ID cards, Software licenses, Hardware warranties, Security certifications, IT compliance documents.

3 Questionnaire

To better understand the needs and goals of our audience, we conducted a questionnaire that reached out to 78 participants. Utilizing Google Forms, we efficiently gathered and analyzed responses to delve into the specifics of our application domain. The questionnaire was thoughtfully designed with carefully crafted questions divided into four main sections:

1. **General Questions:** These questions aimed to gather broad insights into participants' backgrounds, demographics, and general preferences that could influence their interaction with our application.
2. **Questions about the Application:** This section focused on probing participants' expectations, desires, and specific requirements related to our application. It aimed to uncover their motivations for potentially using our product and what features or functionalities they prioritize.
3. **Personal Questions:** These questions delved into participants' individual experiences, challenges, and personal insights relevant to our application domain. This section aimed to capture nuanced feedback that could provide deeper context for understanding their needs and preferences.

By structuring our questionnaire in this manner and leveraging Google Forms for data collection and analysis, we aimed to gather comprehensive insights that will inform the development and refinement of our application. This approach ensures that we are aligning our product offerings closely with the expectations and requirements of our target audience, ultimately enhancing user satisfaction and engagement.

3.1 General Questions

In the following charts is possible see the result about the general questions answered by the respondeners.

A quale fascia d'età appartieni?

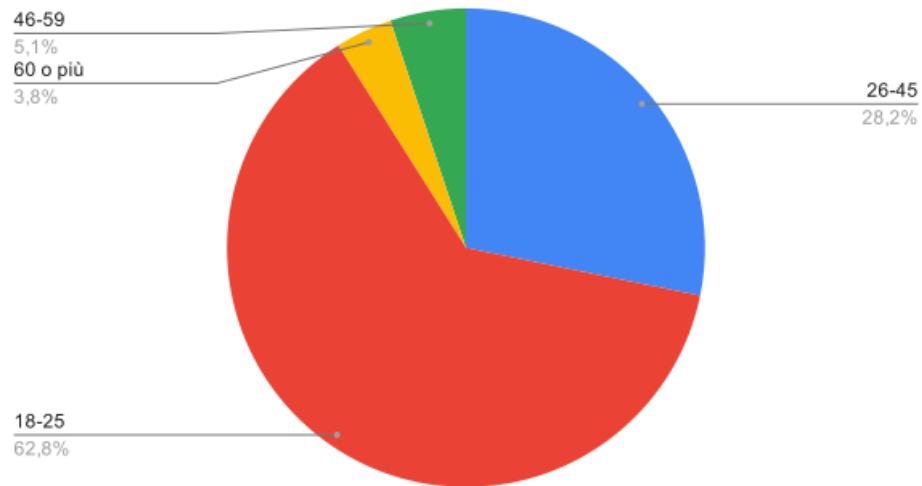


Figure 1: The chart notice that the age groups of respondents coincides with our target age

Qual è il tuo genere?

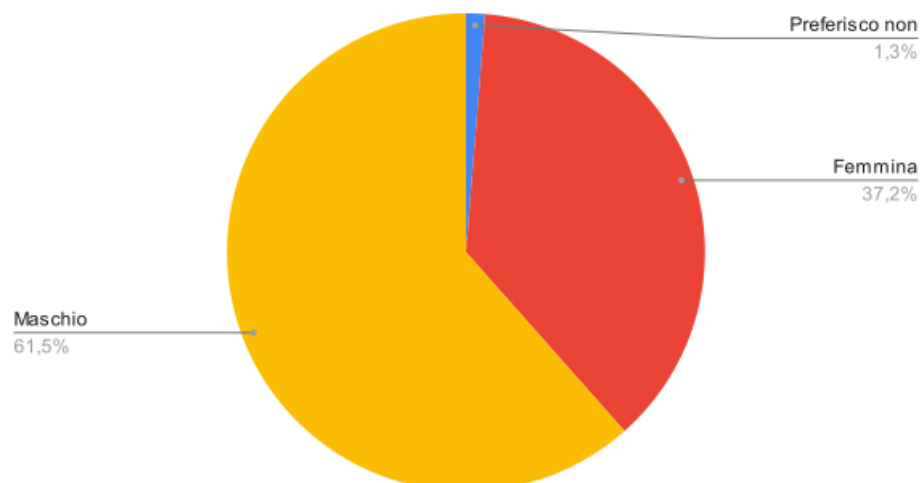


Figure 2: The chart notice the distribution of respondents between the gender.

Il tuo paese di residenza è in Europa?

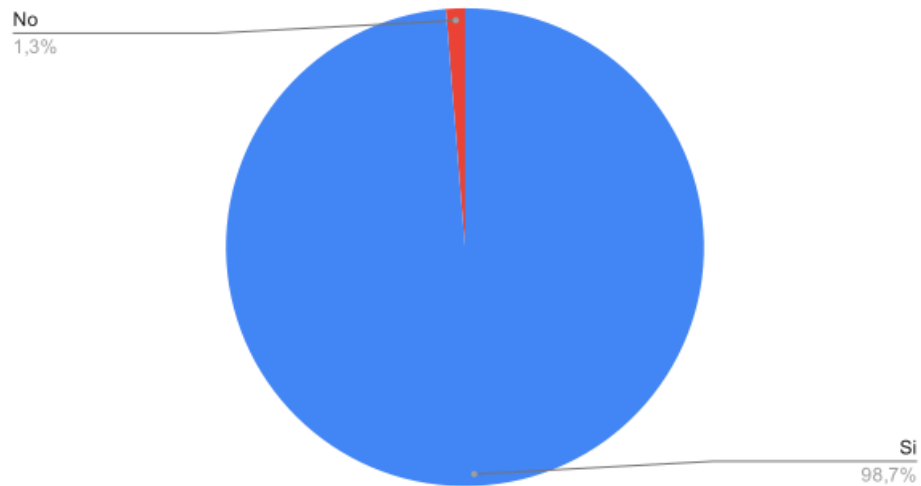


Figure 3: The chart shows that the location of respondents is in Europe that coincides with our target region.

Attualmente lavori part-time o a tempo pieno in un paese della comunità europea?

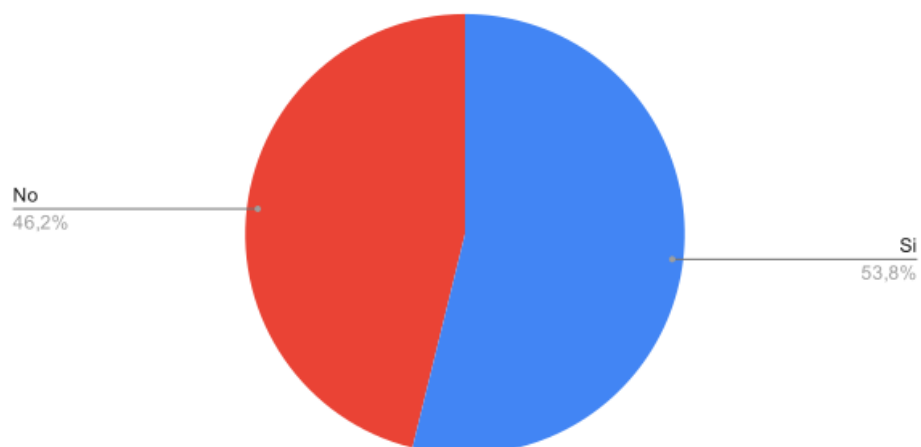
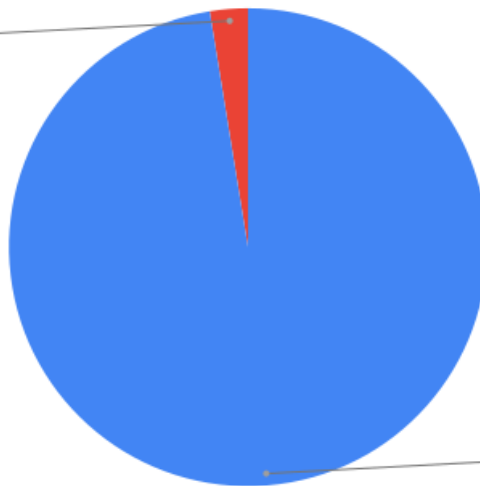


Figure 4: The chart notice that the respondents with a job is greater than the respondents without a job, and this is another important index of our target profile.

Conteggio di Hai uno smartphone Android o iOS?

No
2,6%



Si
97,4%

Figure 5: The chart notice us that the totally of respondents have a smartphone with Android or iOS that is corresponding to our target technology.

3.2 Application Questions

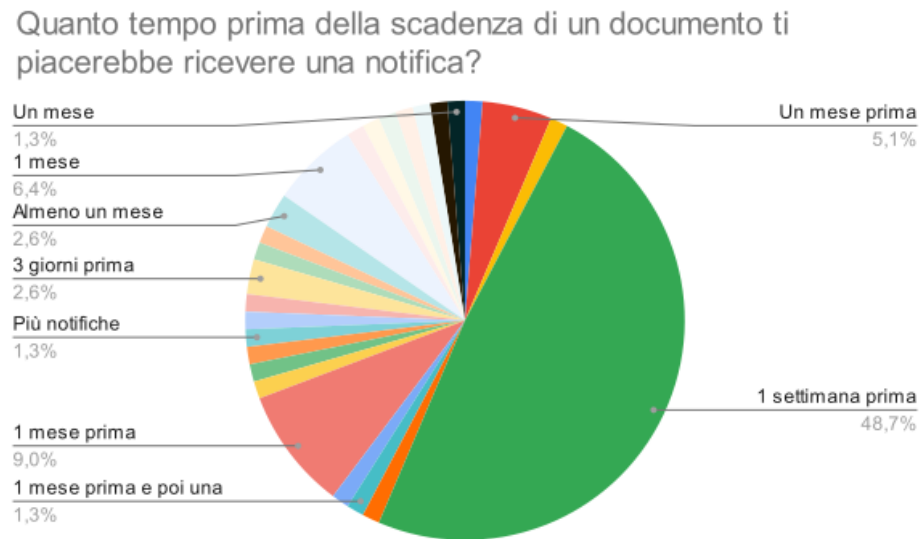


Figure 6: The chart shows the users preference about the default notification time.

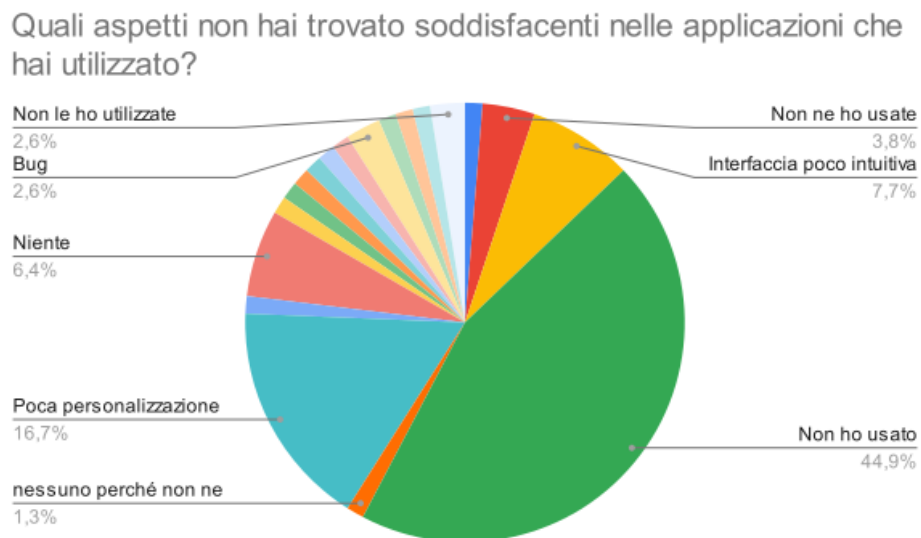


Figure 7: The chart shows what problems the users have found in the other applications.

Se hai già utilizzato delle applicazioni per la gestione delle scadenze, quanto è stato difficile utilizzarle?

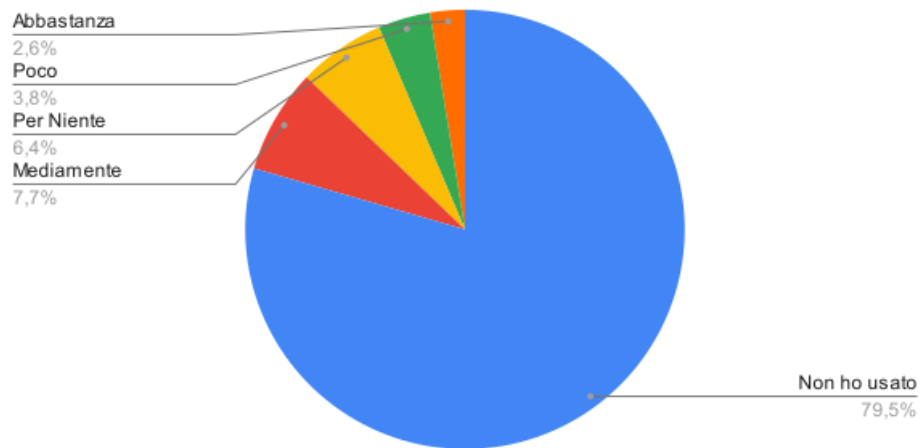


Figure 8: The chart shows how is difficult for the users use the other applications (competitors)

3.3 Personal Questions

Riesci a ricordare le date di scadenza relative ai tuoi documenti? (passaporto, patente, carta di identità, bandi di

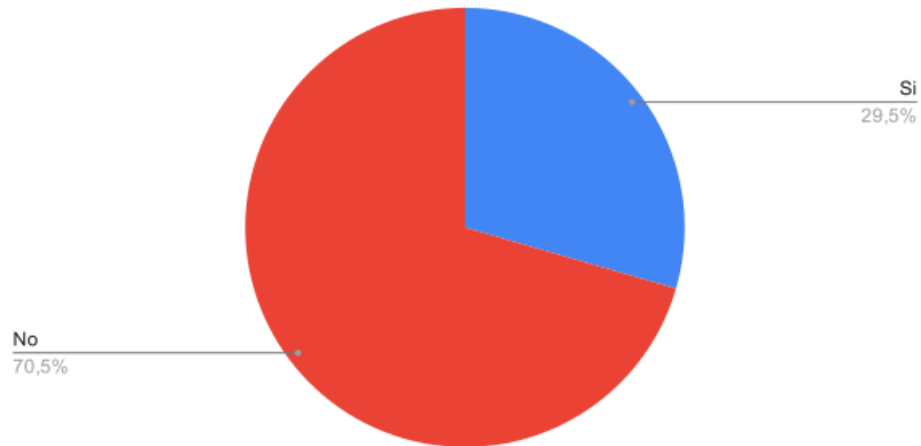


Figure 9: The chart shows how is difficult for the users remember the expiration dates

Quanto spesso ti capita di dover affrontare problemi con documenti scaduti?

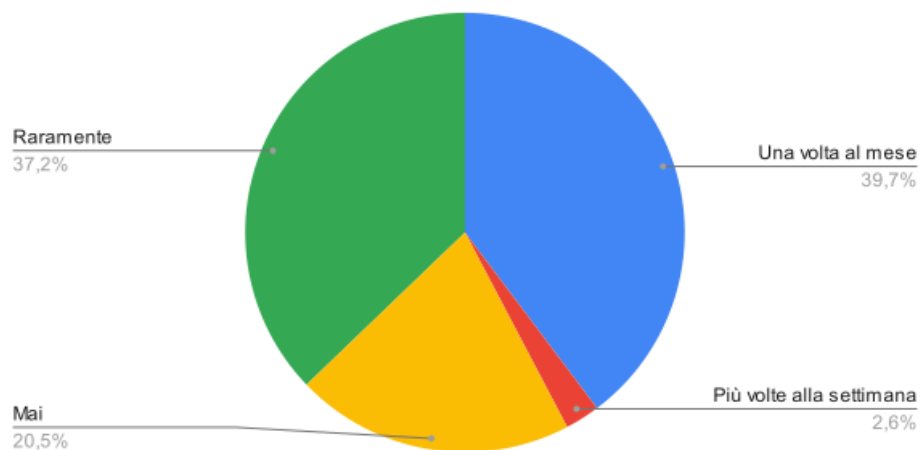


Figure 10: The chart shows if the expiration date of a document was a problem for the real life

Conteggio di Quanto sarebbe importante per te un'applicazione mobile che consente di ricordarti con largo anticipo le date di

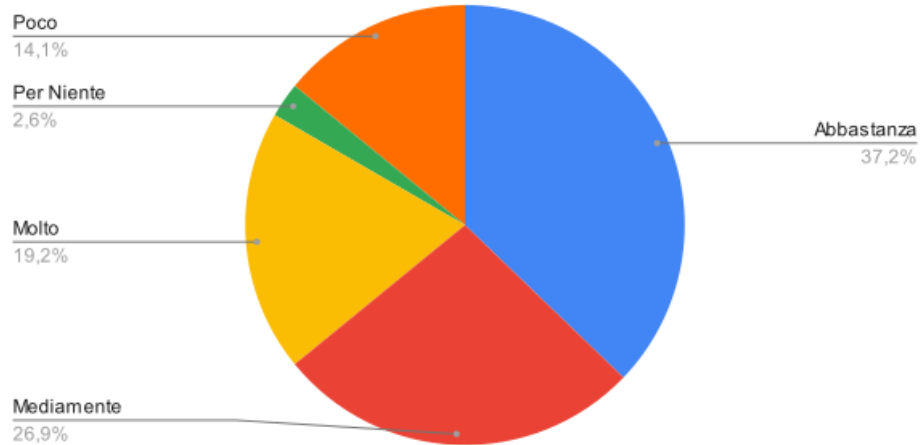


Figure 11: The chart shows how is important for the users using an helpfull application

Conteggio di Utilizzeresti la nostra applicazione?

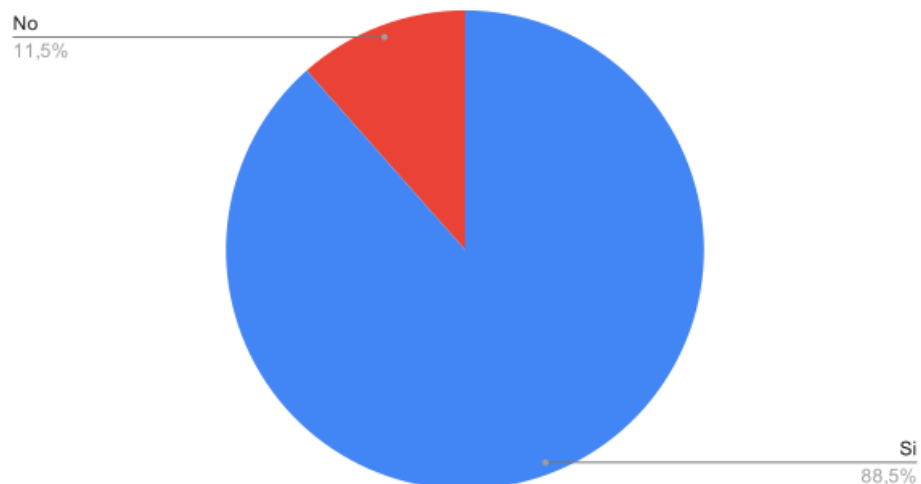


Figure 12: The chart shows if the users are available to use the our application

4 Task and Dialog Analysis

Another important phase is understanding how users interact with systems is crucial for designing intuitive and efficient interfaces. Task and dialog analysis are two fundamental methodologies that help designers and researchers dissect and understand user interactions, ultimately leading to better system design and user experience. Task analysis is a systematic approach to understanding the activities users perform to achieve their goals when using a system. This involves breaking down tasks into smaller, manageable components to study the user's workflow in detail. Task analysis helps identify user needs, uncover potential problems, and inform the design of user interfaces by ensuring they align with how users naturally perform tasks.

Dialog analysis focuses on the interaction between the user and the system, particularly the communication patterns and language used during this interaction. This analysis is crucial for designing systems that support effective and efficient communication, whether through graphical user interfaces, command-line interfaces, or voice-controlled systems. One of common techniques used in Human Computer Interaction is **Hierarchical Task Analysis (HTA)** focuses on decomposing tasks into sub-tasks and operations, creating a structured hierarchy that shows how each component contributes to achieving the overall goal. HTA breaks down tasks into sub-tasks and operations. It provides a clear visualization of the steps users take to achieve their goals, highlighting dependencies and sequences in the workflow. HTA is particularly useful for identifying redundant steps, optimizing processes, and ensuring that the design supports users' natural task flows.

To do this analysis step we also used **State Transition Network (STN)**, also known as State Transition Diagram or State Machine, is a graphical representation of a system that illustrates the different states a system can be in and how it transitions from one state to another based on user actions or events. It helps to demonstrate the flow of tasks, depicting how the system responds to user actions and transitions from one state to another, thereby facilitating a better understanding of the interaction dynamics and aiding in the optimization of task performance.

4.1 Hierarchical Task Analysis (HTA)

4.1.1 Set custom notification

This task is linked with the view document list and allows to change only the expiration settings without changing the other information of a document.

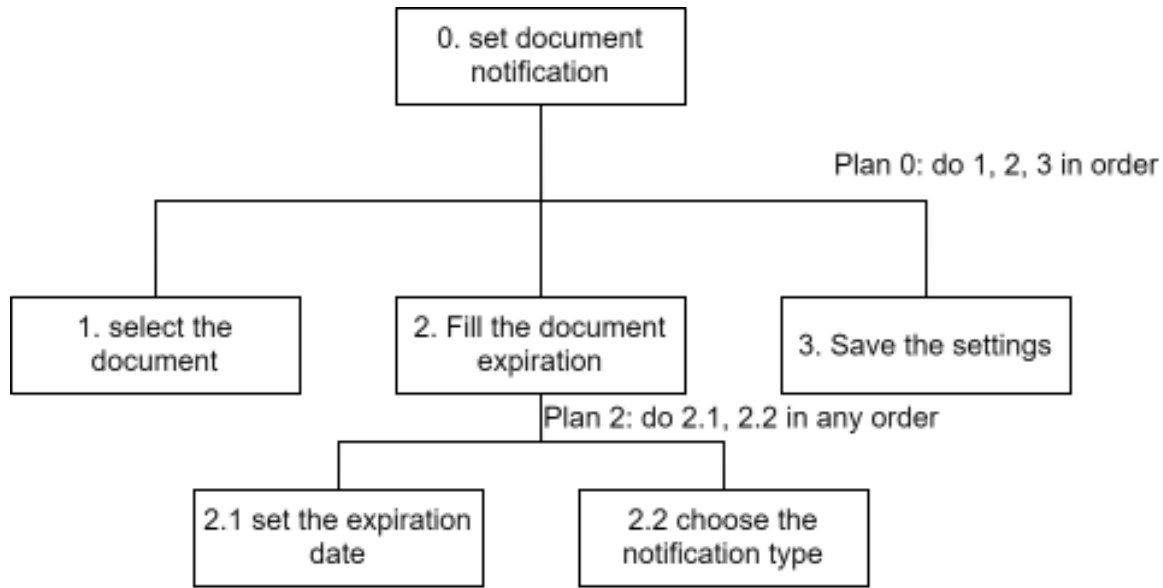


Figure 13: HTA for the requirement set custom notification

4.1.2 Add a new document

This is the classical way to add a document, this option allows the user to navigate on the file system of device to upload the document on the remote repository. The related HTA in the following picture explain better the details of this operation.

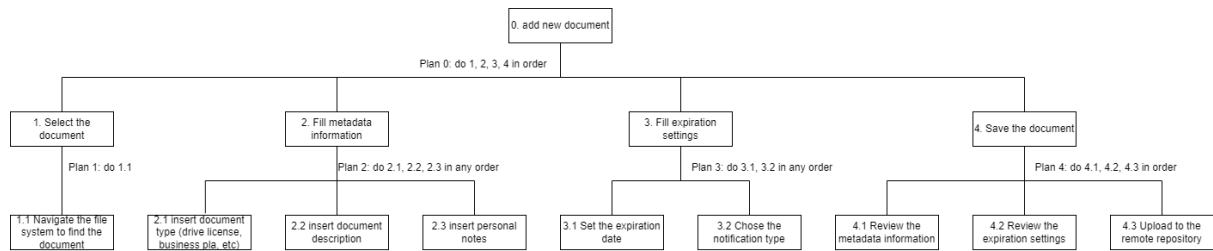


Figure 14: HTA for the requirement Add new document

4.1.3 Add a new document using the camera

The system allows to upload documents to manage using the phone camera. With this feature is possible to load a document that is not digital and upload it in the remote repository. Then in the following picture is present the related HTA.

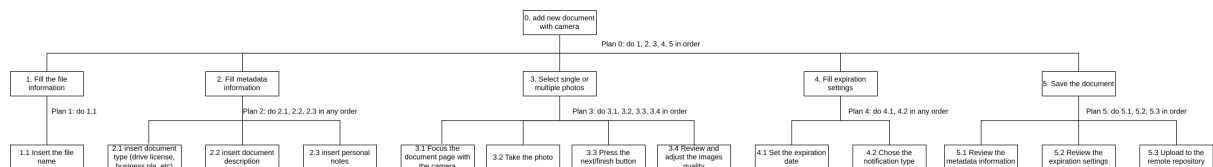


Figure 15: HTA for the requirement Add new document using the camera

4.1.4 View document list

This task allows the users to view all uploaded documents using the filters to adjust the search. Is it possible looking for the metadata information, documents information and expiration dates.

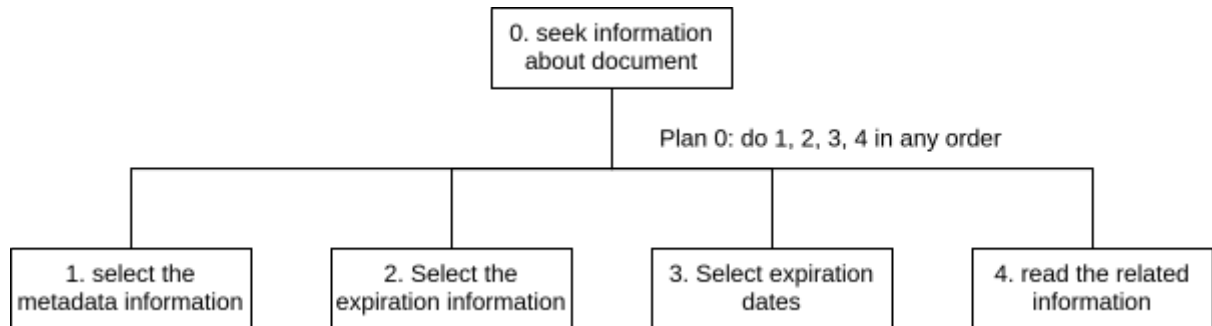


Figure 16: HTA for the requirement View documents list

4.1.5 Edit an existing element

This task allows the users to view all uploaded documents using the filters to adjust the search. Is it possible looking for the metadata information, documents information and expiration dates.

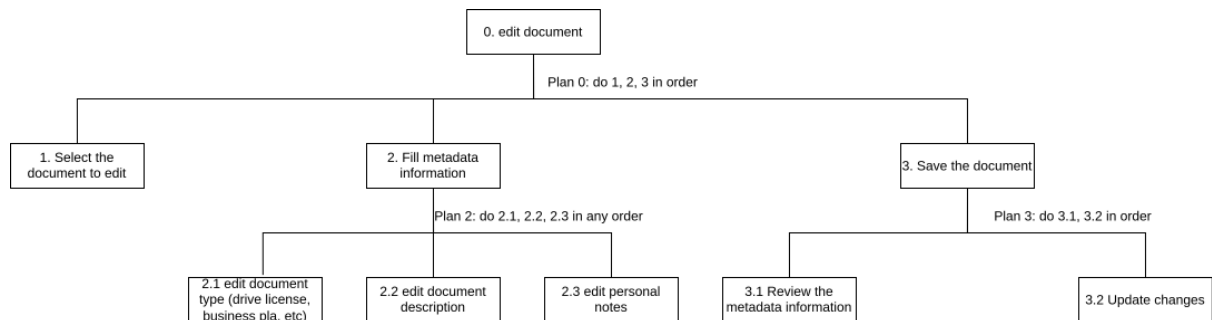


Figure 17: HTA for the requirement Edit an exisisting element

4.1.6 Remove document

This task is linked to the view document list and allows to remove a document from the system.

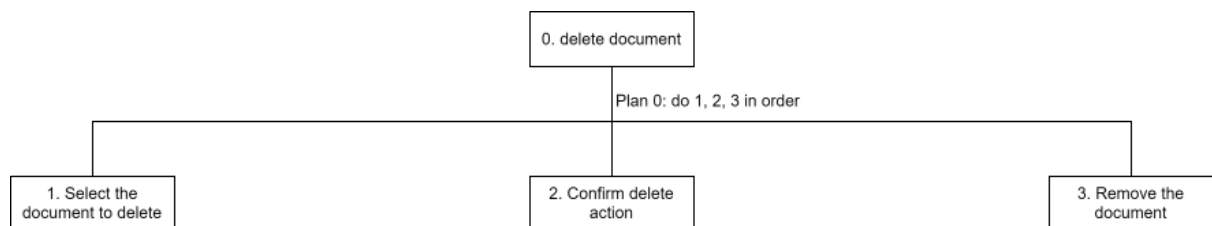


Figure 18: HTA for the requirement Remove documents

4.2 State Transition Network (STN)

In this section, we will examine the State Transition Network (STN) corresponding to the specific tasks previously analyzed through Hierarchical Task Analysis (HTA). The tasks and their significance remain unchanged from our earlier descriptions. However, this time we will focus on the interactions between the user and the system, detailing the dialogue that occurs during these tasks, including user actions and system responses.

4.2.1 Add a new document

This diagram covers the necessary steps and different states needed to add a document either from a saved file or scan it using the smartphone camera, adding the document metadata and adjusting the expiration settings.

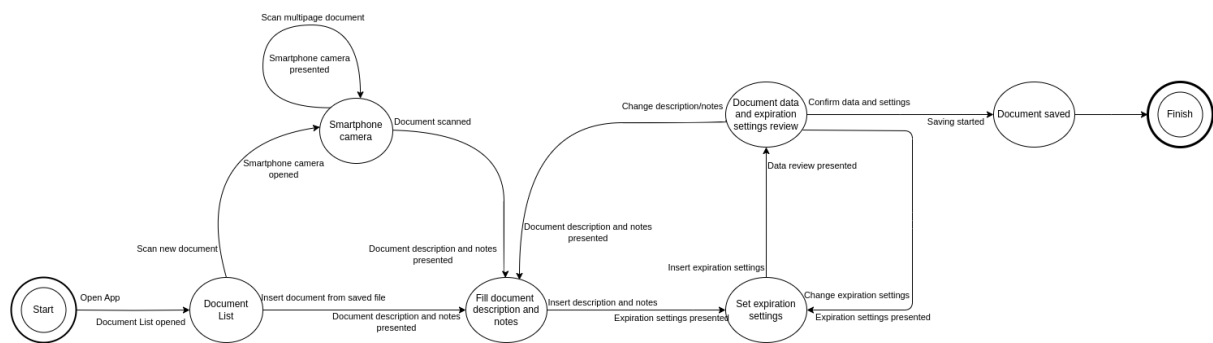


Figure 19: STN for add new document

4.2.2 Edit document

This diagram covers the necessary steps and different states needed to edit an existing document. It shows the different steps necessary to edit the document metadata and the expiration settings.

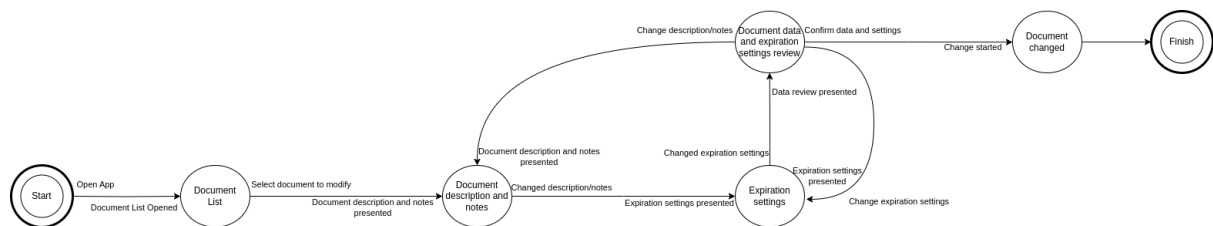


Figure 20: STN for edit document

4.2.3 Remove document

This diagram shows the steps and different states necessary to delete an existing document.

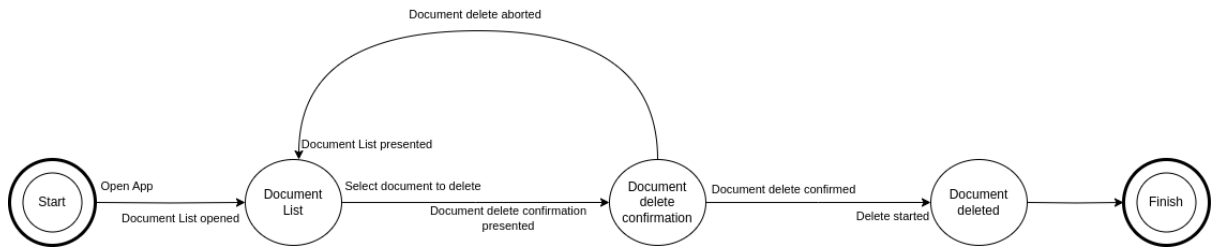


Figure 21: STN for remove document

4.2.4 View document list

This diagram shows the steps and different states necessary to view and filter the list of available documents.



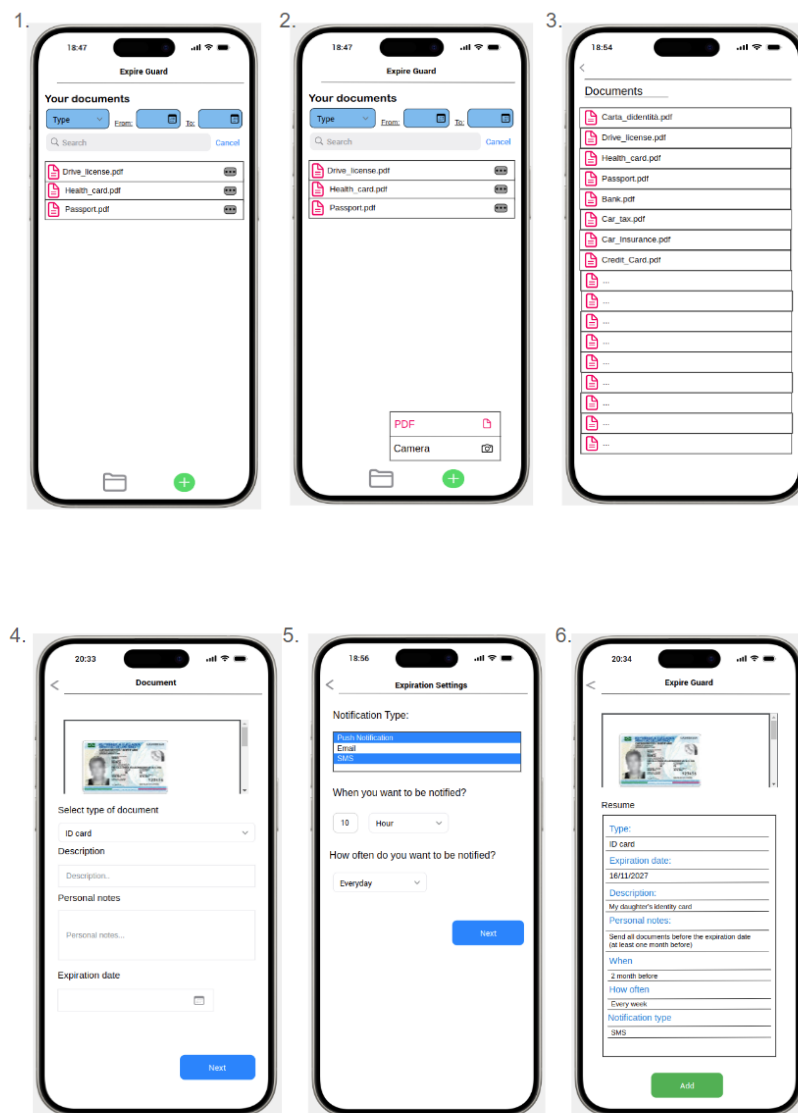
Figure 22: STN for view documents list

5 Prototype Zero

After gathering information from user questionnaires, conducting a competitor analysis, and creating tasks and dialogues using the methods described earlier, we moved on to developing the first prototype of our application interface. We used a tool called Justinmind, which allowed us to build the prototype by defining various windows, their connections, and the overall look and feel of the application. This tool helped us create a simple, clear, but accurate representation of our idea and its functionalities. In the rest of the chapter, we are going to illustrate the prototype, dividing it by its different functionalities. This walkthrough will show how each feature is designed to meet user needs and contribute to the overall user experience.

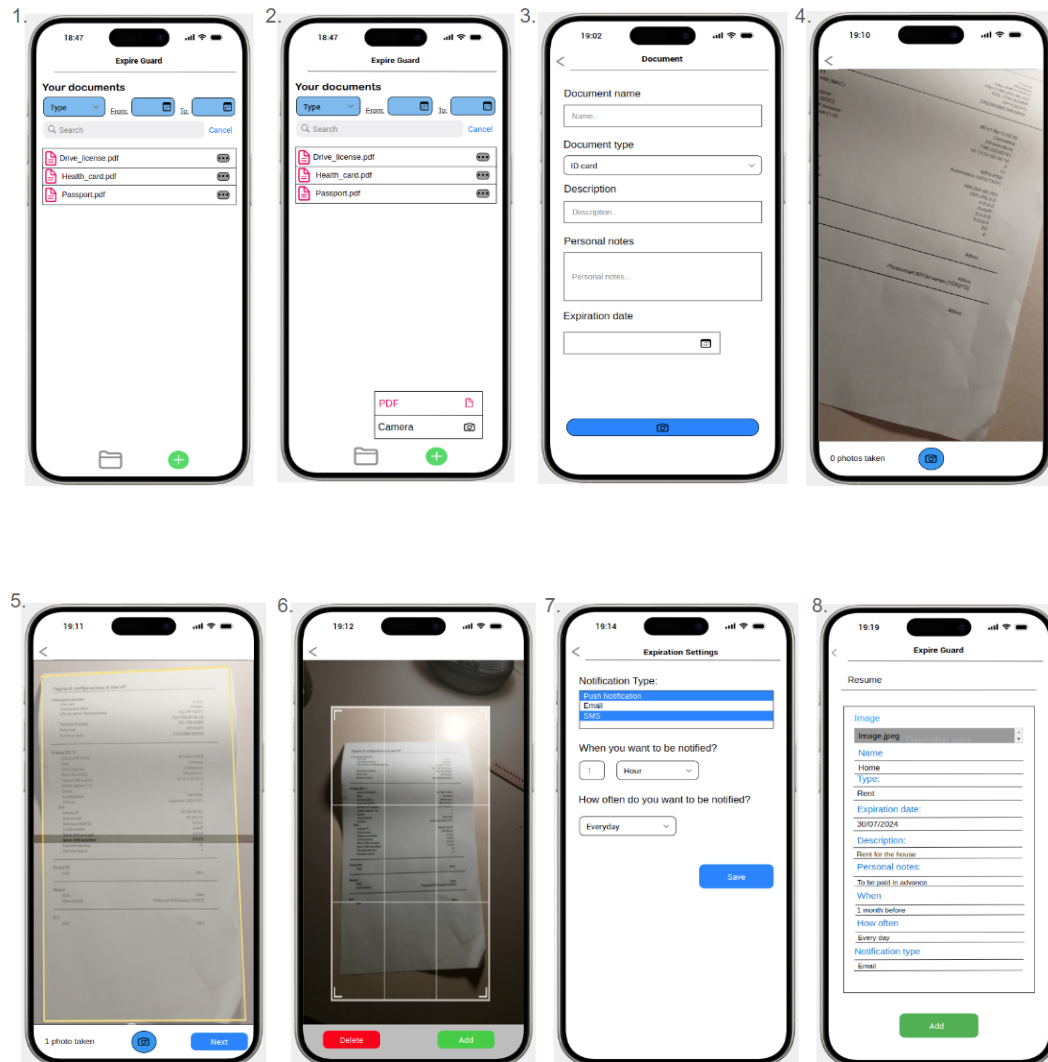
5.1 Add document from saved file

The first section outlines the process of adding a document from saved files. It illustrates the steps you take, starting from opening the application to successfully adding a new document from a saved file.



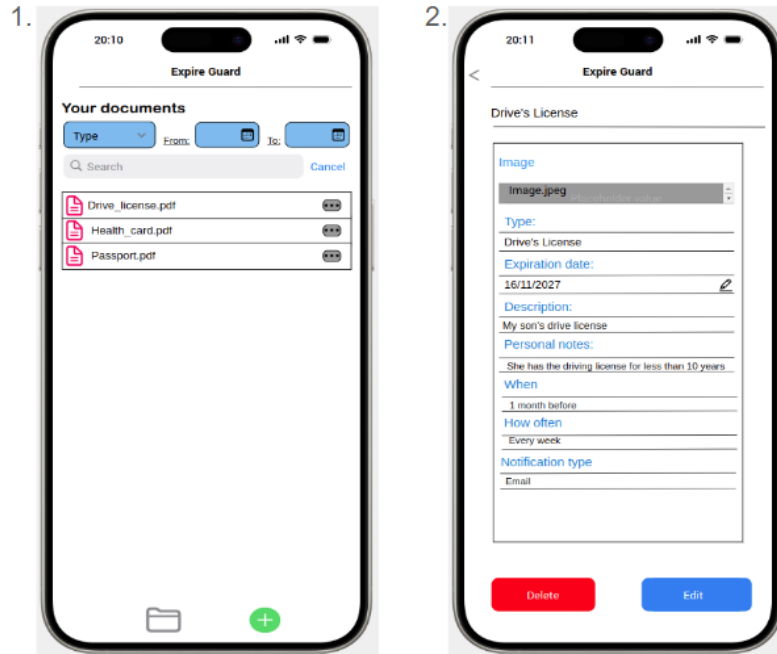
5.2 Add document using camera scan

The second section is similar to the first one, but in this case it illustrates the process of adding a document using the smartphone camera to scan it.



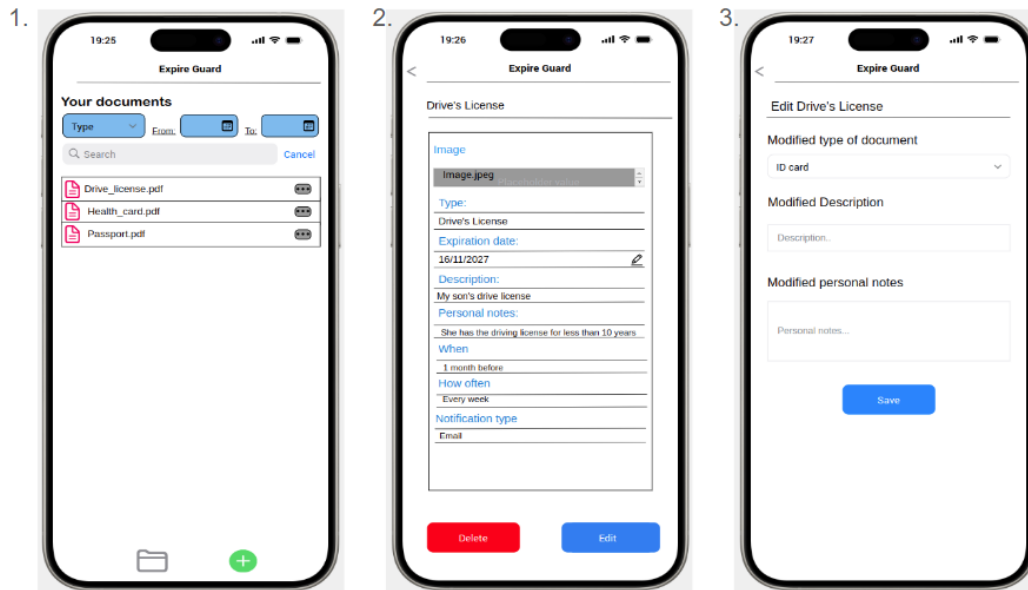
5.3 View document

The third section explains how to view the details of a saved document. It also shows the presence of various filters on the document archive page to perform a custom search of saved documents.



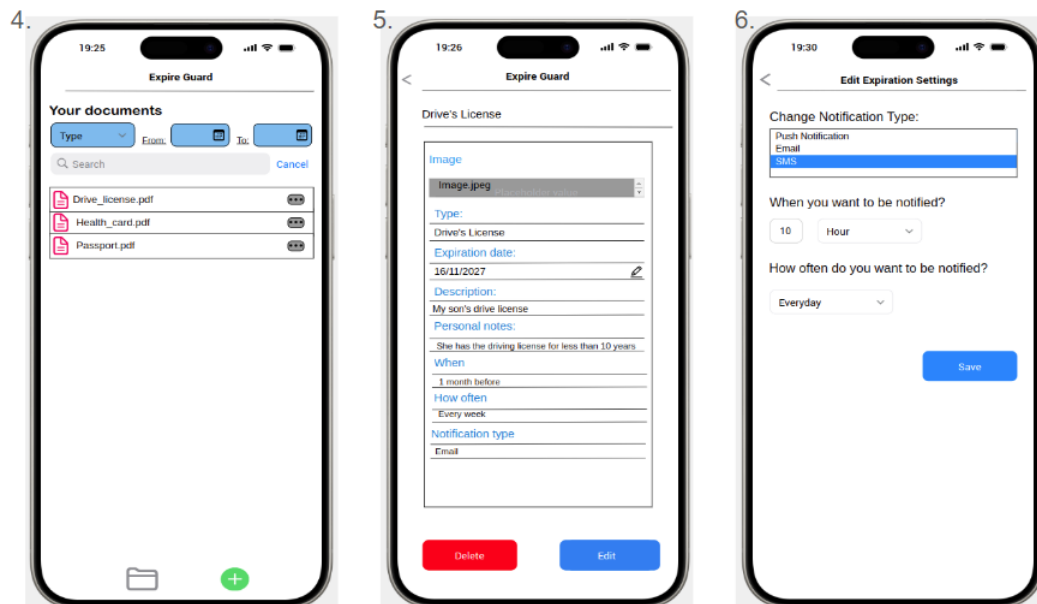
5.4 Edit document description and personal notes

The fourth section illustrates the process of editing a saved document Description and Personal Notes.



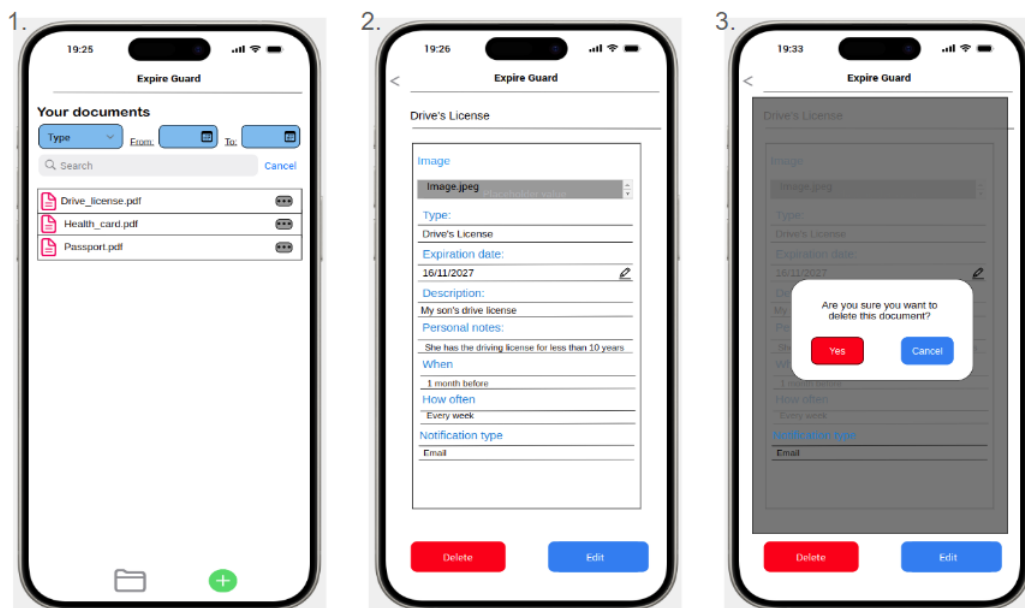
5.5 Edit document Expiration date and Expiration Settings

The fifth section illustrates the process of editing a saved document Expiration date and Expiration Settings.



5.6 Delete document

The last section illustrates the process of deleting a saved document.



6 Expert Based Evaluation

Once the initial prototype is complete, the next step is to conduct an expert-based evaluation. This critical phase aims to identify and resolve issues that emerged during the first implementation. By addressing these problems early, we can ensure that the subsequent user evaluation focuses on other important aspects.

Expert evaluations help verify whether the system follows established design and usability principles. These principles, guidelines, and standards improve system usability and cover three key aspects:

- **Learnability:** How easily a new user can effectively interact with the system and achieve optimal performance.
- **Flexibility:** The various ways in which users and the system can exchange information.
- **Robustness:** The level of support provided to users in achieving successful, goal-directed behavior.

Applying these evaluations ensures that the system meets design and usability standards, making the user evaluation phase more focused and effective.

6.1 Cognitive Walkthrough

The first expert evaluation we used on our system is the Cognitive Walkthrough (CW). It checks how well the design helps users learn to use the system and achieve their goals. Experts use cognitive psychology to understand the impact of an interaction on a user, the thought processes involved, and potential learning problems that may arise from the design.

The expert needs a prototype of the system, a description of the task, a complete list of actions needed to perform it, and information about the users. For each action, the expert will answer the following questions:

- Does the action match the user's goal at that point?
- Will users see that the action is available?
- Once users find the correct action, will they know it's the one they need?
- After the action is taken, will users understand the feedback they get?

In our case, the task chosen for evaluation is: Add a new document from the saved files.
The complete list of actions and responses needed to perform the task is:

- Act. 1: Click on the button "+" at the bottom of the screen.
Resp. 1: Display shows a popup with two options "PDF" and "Camera".
- Act. 2: Click on the button "PDF" in the popup.
Resp. 2: Display moves to "Documents" page.
- Act. 3: Click on "Carta_didentità.pdf" in the displayed PDFs list.
Resp. 3: Display moves to "Document" page.
- Act. 4: Click on the dropdown list under text "Select type of document".
Resp. 4: Dropdown list options displayed.
- Act. 5: Select "ID Card" from the list.
Resp. 5: "ID Card" selected from the list.
- Act. 6: Click on the text area "Description..." under text "Description".
Resp. 6: The keyboard is shown and a flashing cursor appears in the text area.
- Act. 7: Type "Description text test".
Resp. 7: In the text area appears text "Description text test".
- Act. 8: Click on the text area "Personal notes" under text "Personal notes".
Resp. 8: The keyboard is shown and a flashing cursor appears in the text area.
- Act. 9: Type "Personal notes about the document".
Resp. 9: In the text area appears text "Personal notes about the document".
- Act. 10: Click on the input field under text "Expiration date".
Resp. 10: The calendar is shown.
- Act. 11: Select date 31/07/2024.
Resp. 11: Date 31/07/2024 is displayed in the input area.
- Act. 12: Click on the button "Next" in the lower right corner of the display.
Resp. 12: Display moves to "Expiration Settings" page.
- Act. 13: Click on "Push Notification" and "Email" in the multi select list under text "Notification Type".
Resp. 13: "Push Notification" and "Email" are highlighted in the multiselect.
- Act. 14: Click on the input area under text "When you want to be notified?"
Resp. 14: The keyboard is shown and a flashing cursor appears in the text area.

Act. 15: Type “1”.

Resp. 15: “1” appears in the input area.

Act. 16: Click on the drop down list under text “When you want to be notified?”.

Resp. 16: Dropdown list options displayed.

Act. 17: Select “Month” from the list.

Resp. 17: “Month” is selected.

Act. 18: Click on the drop down list under text “How often do you want to be notified?”.

Resp. 18: Dropdown list options displayed.

Act. 19: Select “Everyday” from the list.

Resp. 19: “Everyday” is selected.

Act. 20: Click on the button “Next” in the lower right corner of the display.

Resp. 20: Display moves to “Resume” page.

Act. 21: Click on the button “Add” in the lower center of the display.

Resp. 21: Display moves to “Document list” page.

The feedback from the expert revealed some potential problems that needed to be addressed.

Below, we will only show the actions that had issues and the related question:

Act. 7: Type “Description text test”.

Question	Answer
Q1 Is the effect of the action the same as the user’s goal at that point?	It is not entirely clear what the user should write. Is it mandatory? Is it the title of the document? Consider adding an example placeholder.
Q3 Once users find the correct action, will they know it is the one they need?	Is it not clear if it is mandatory.

Act. 9: Type “Personal notes about the document”.

Question	Answer
Q1 Is the effect of the action the same as the user’s goal at that point?	Same as above + it is not clear if the two fields overlap.
Q3 Once users find the correct action, will they know it is the one they need?	Is it not clear if it is mandatory.

Act. 13: Click on “Push Notification” and “Email” in the multi select list under text “Notification Type”.

Question	Answer
Q2 Will users see the action is available?	Yes - although the selection method is not standard for mobile views.

Act. 17: Select “Month” from the list.

Question	Answer
Q3 Once users find the correct action, will they know it is the one they need?	The label is not entirely clear.

Act. 19: Select “Everyday” from the list.

Question	Answer
Q3 Once users find the correct action, will they know it is the one they need?	The label is not entirely clear.

Act. 21: Click on the button “Add” in the lower center of the display.

Question	Answer
Q4 After the action is taken, will users understand the feedback they get?	The feedback is not shown in the prototype.

6.2 Heuristic Evaluation

The other expert-based evaluation we used for our system is the heuristic evaluation (HE). In this method, experts identify and test a set of usability criteria to see how well the system meets them. They check if the system’s behavior is predictable, if it is consistent, and how feedback is given to the user. This process is like debugging the design and does not require an understanding of the system’s goals and purpose, as it only checks these general criteria.

For our evaluation, the expert performed a HE on Prototype Zero. The possible issues were marked with a “severity” rating, as detailed below:

- 1 - I don’t agree that this is a usability problem at all
- 2 - Cosmetic problem only
- 3 - Minor usability problem
- 4 - Major usability problem
- 5 - Usability catastrophe

The table below shows the violations found in our system, along with their severity ratings:

Page	Heuristic violated	Severity(1-5)	Description/ comment
Home	Visibility of system status	3	Is it not entirely clear if a filter is applied, and how the documents are organized (e.g.by adding date, by expiration..)
Home	Match between the system and the real world, Recognition rather than recall	3	How does the filter work?“From-to” refers to which property of the documents (e.g.expiration date)?
Home	Visibility of system status	3	What does the “folder” icon at the bottom stand for? Is it selected?
Home	Consistency and standards	2	The “...” icon is usually used in web apps (not mobile) and it usually opens a cascade menu.I suggest you consider alternative more standard icons.
Add document	Flexibility and efficiency of use	2	The difference between description and personal notes is not clear, consider merging the two fields.

Page	Heuristic violated	Severity(1-5)	Description/ comment
Add document	Error prevention	2	Is it not clear which fields are mandatory.
Expiration settings	Consistency and standards	2	The proposed multiple selection input is not standard for mobile views, consider a multiple options check list.
Expiration settings	Match between system and the real world	3	The two timing settings labels are not entirely clear - at first, I did not understand what they were referring to.
Add document	Flexibility and efficiency of use	2	Same comment as above + Consider if the document name is really necessary, and if yes it should be an editable field in the edit view
Edit document	Visibility of system status, Error prevention	3	It is good practice to show the current value of a field while editing it, to be sure the user is aware of what he is modifying.
Edit document - notification settings	Visibility of system status, Recognition rather than recall	3	Is this a different page from the "edit document" one? How do you arrive at it? Consider unifying them.
General comment	Consistency and standards	1	Page titles are not consistent - they only sometimes reflect the focused feature.

6.3 Gatherings

The results of both evaluations, the CW and the HE, have underscored the need for several adjustments to refine and improve the prototype we developed. These evaluations identified specific areas where our design could be enhanced to better support user interaction and overall usability.

Here we will outline some of the key modifications we have implemented based on the feedback from these evaluations. However, a more detailed explanation of all the changes and improvements will be provided in the next section:

- We have merged the Edit Document metadata page with the Edit Expiration Settings page in a single page to help users avoid errors and facilitate the learning process.
- We have unified the fields relative to Document's Description and Personal Notes to improve the user experience making it more understandable.
- We have changed some labels to improve readability and understanding for new users.
- We have improved our choices of input types and buttons to make user interaction with the system a more pleasant experience aimed at mobile devices.
- We have added a new editable field relative to the Document's name called "Name".
- We have improved the user feedback by adding popups to let users know the result of their actions and made more clear which fields are mandatory during the Adding Document phase.

The insights gained from CW and HE have been instrumental in refining our prototype to such an extent that we have now developed an improved version, Prototype One.

7 Prototype One

8 User Based Evaluation

8.1 Think Aloud

8.2 Controlled Experiment

8.2.1 The experiments

8.2.2 ANOVA