# Sapienza University of Rome
## Human Computer Interaction
## Expire Guard
## 2023/2024

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# Contents

# 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 expire, 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 and manage them with the notification system.
- **Set notifications on files on your phone:** Manage the files on your phone and add them to 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 on 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 tracking gets notified in the UI of the successful operation alongside an email. When an alert period is triggered, the User receives a notification 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. |
| Feeback to the User | When the User adds a new document and tracking gets notified in the UI of the successful operation alongside 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 feature and 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.

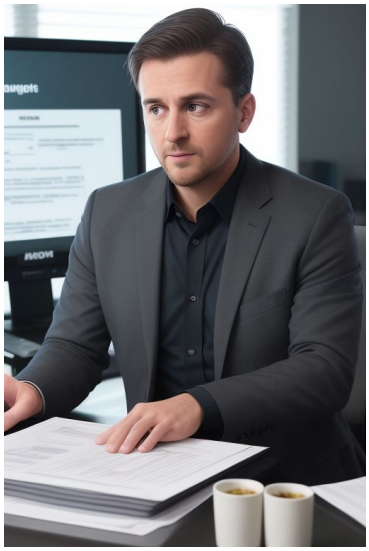
## 2.2 User Analysis

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 user analysis and informing the application's development process.

### 2.2.1 First persona: David



**Persona:**
David, a 35-year-old real estate agent, starts his day early in the real estate office. His desk is cluttered with property listings, lease agreements, and maintenance records. David prides himself on providing excellent service to landlords and tenants alike, but he often finds himself overwhelmed by the sheer volume of documents and deadlines he needs to manage.

**Scenario:**
David prepares for a morning meeting with a potential landlord client, he notices a lease agreement buried beneath a stack of papers. It's a renewal notice for a rental property due in two weeks. David recalls an incident where he missed a lease renewal deadline, causing frustration for the tenant and a delay in securing rental income for the landlord. He realizes that managing multiple property leases and maintenance schedules manually is becoming increasingly challenging and prone to errors.

### 2.2.2 Second persona: Emily

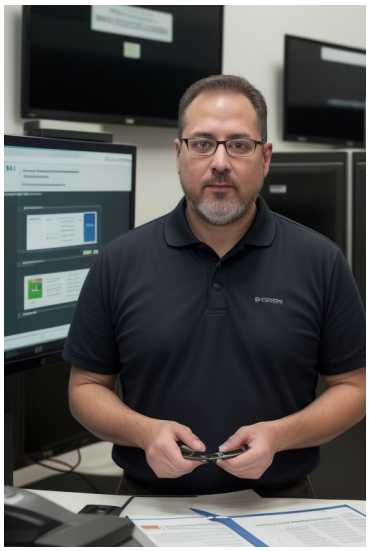
**Persona:**

Emily, a 33-year-old, is a freelancer working from her home office. Her clients are scattered across the globe, demanding high-quality designs and timely deliveries. Emily juggles multiple projects, each with its own set of contracts and deadlines. Additionally, she relies on various software tools, all of which require periodic license renewals. She also needs to keep track of personal documents like her passport and ID, as she frequently travels for work.

**Scenario:**

One Tuesday afternoon, Emily is deep into designing a new logo for a major client when her design software suddenly stops working. After a few moments of confusion, she realizes her software license has expired. This unexpected disruption causes her to miss an important client meeting, leading to frustration and stress. Determined to prevent such incidents in the future, Emily searches for a comprehensive solution.

### 2.2.3 Third persona: Alex



**Persona:**

Alex a 45-year-old small business owner, runs a local hardware store. Alex is responsible for every aspect of the business, from inventory management to customer service. One of his most critical yet challenging tasks is managing various business-related documents, such as licenses, permits, and insurance policies. With a busy schedule and numerous responsibilities, Alex often struggles to keep track of expiration dates, leading to potential legal and operational issues.

**Scenario:**

One day, while preparing for a busy weekend at the store, Alex receives a notice that his business license is about to expire. He realizes that he had forgotten to renew it. This oversight could result in fines or even temporary closure, which would be detrimental to his business. Determined to find a solution, Alex searches for a reliable way to manage his 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 a 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

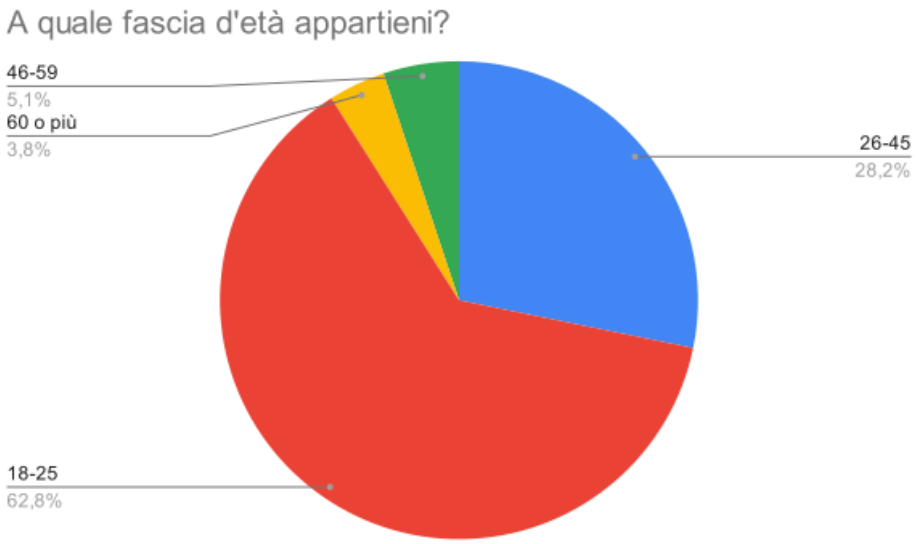



Figure 1: The chart notice that the age groups of respondents coincides with our target age

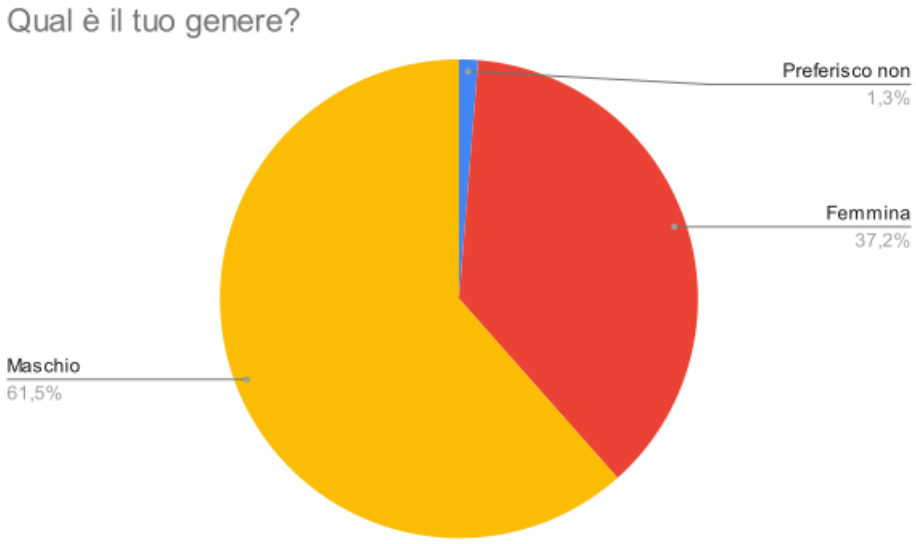



Figure 2: The chart notice the distribution of respondents between the gender.

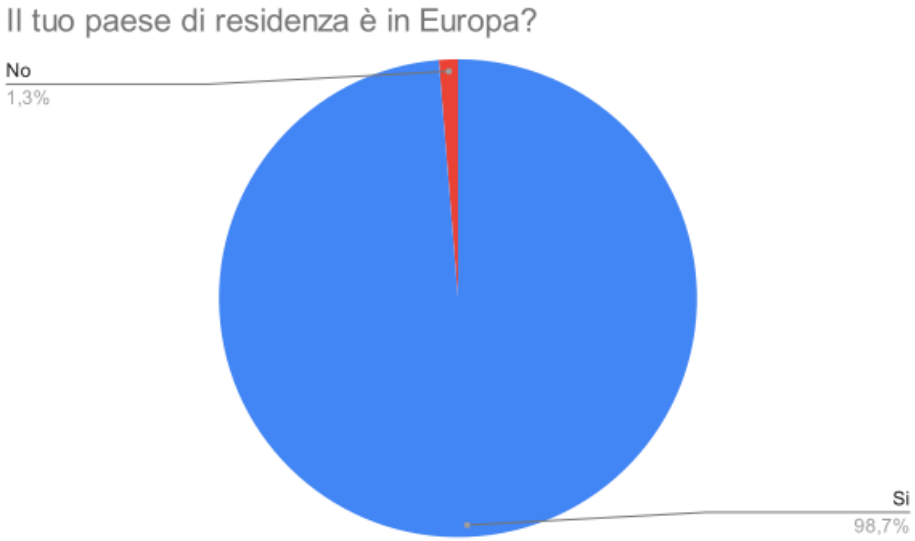



Figure 3: The chart shows that the location of respondents is in Europe that coincides with our target region.


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.


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

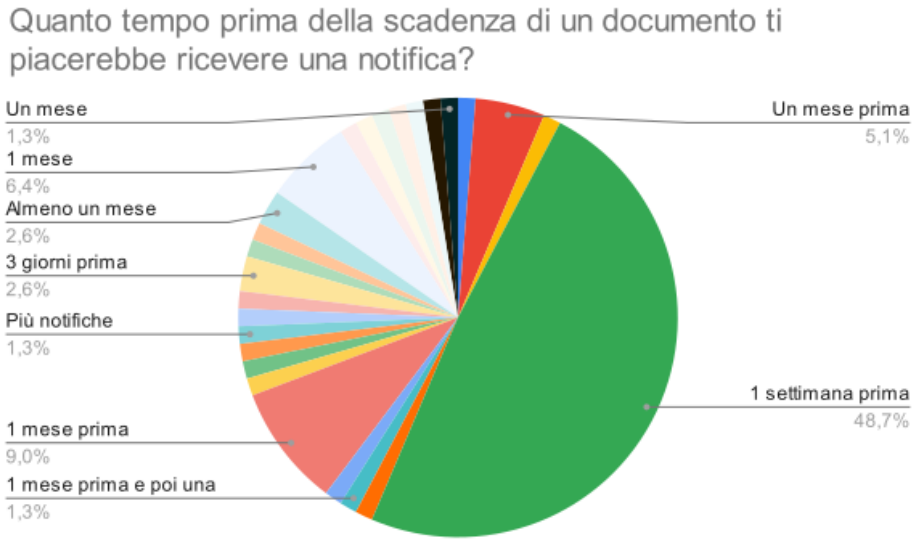



Figure 6: The chart shows the users preference about the default notification time.

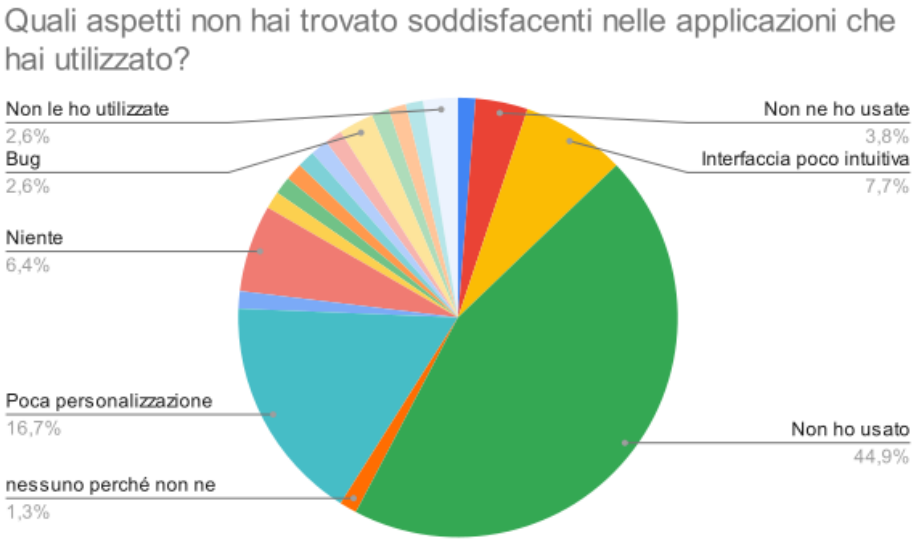



Figure 7: The chart shows what problems the users have found in the other applications.

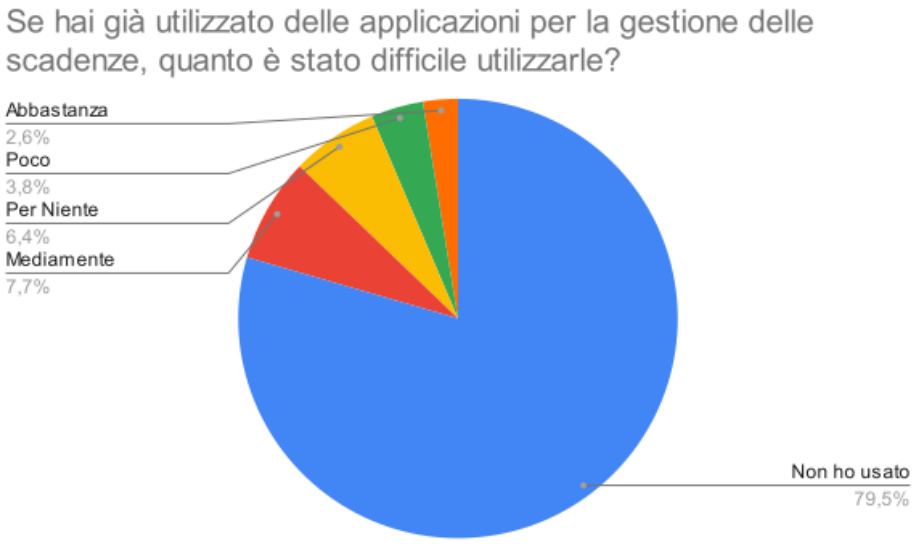



Figure 8: The chart shows how is difficult for the users use the other applications (competitors)

## 3.3 Personal Questions


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

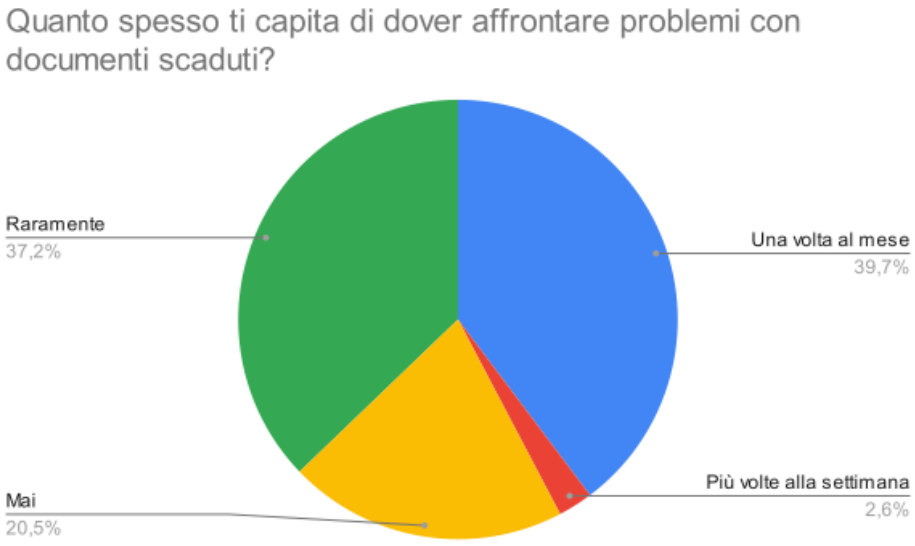



Figure 10: The chart shows if the expiration date of a document was a problem for the real life

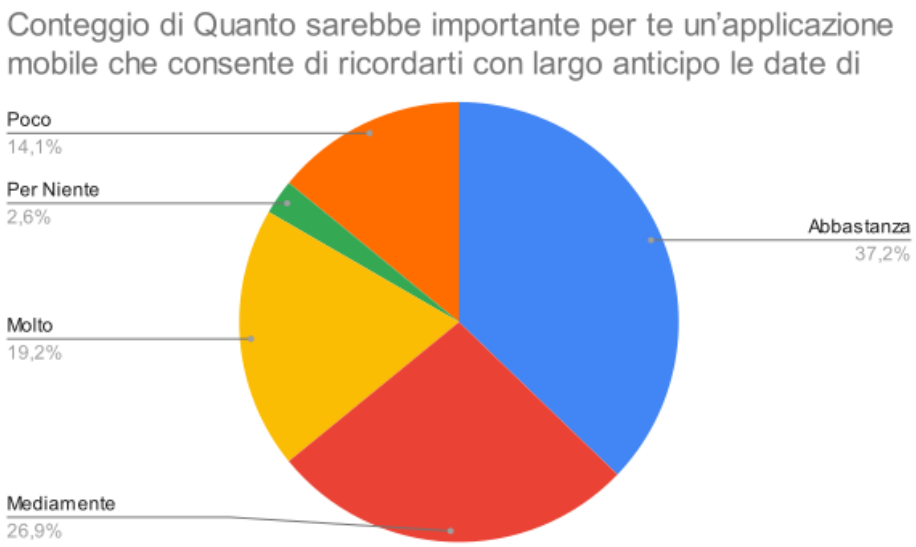



Figure 11: The chart shows how is important for the users using an helpfull application


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 the 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, which 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.

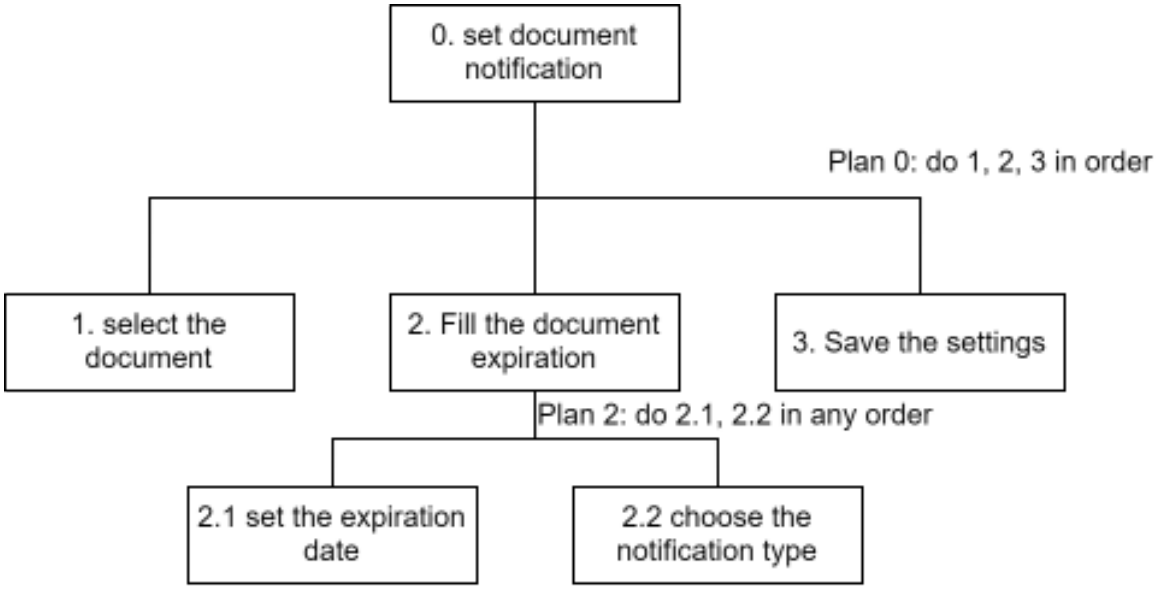



Figure 13: HTA for the requirement set custom notification

### 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 the device to upload the document on the remote repository. The related HTA in the following picture explains better the details of this operation.

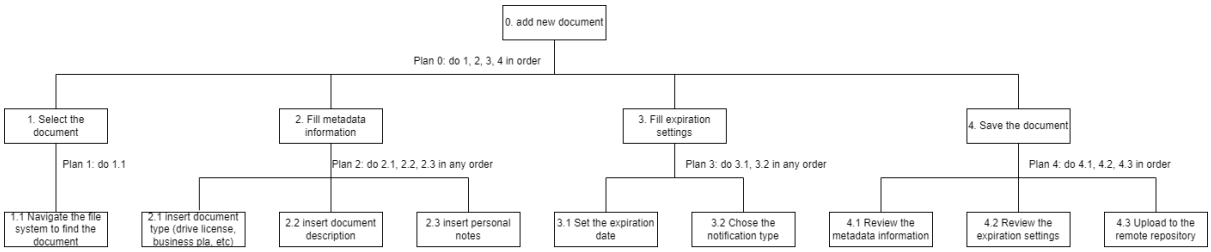



Figure 14: HTA for the requirement Add new document

### 4.1.3 Add a new document using the camera

The system allows to upload of documents to be managed 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.

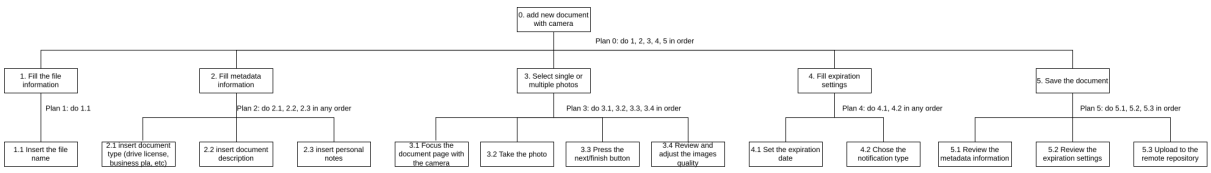



Figure 15: HTA for the requirement Add new document using the camera

### 4.1.4 View document list

This task allows the users to view all uploaded documents using the filters to adjust the search. It is possible to look for the metadata information, document information, and expiration dates.

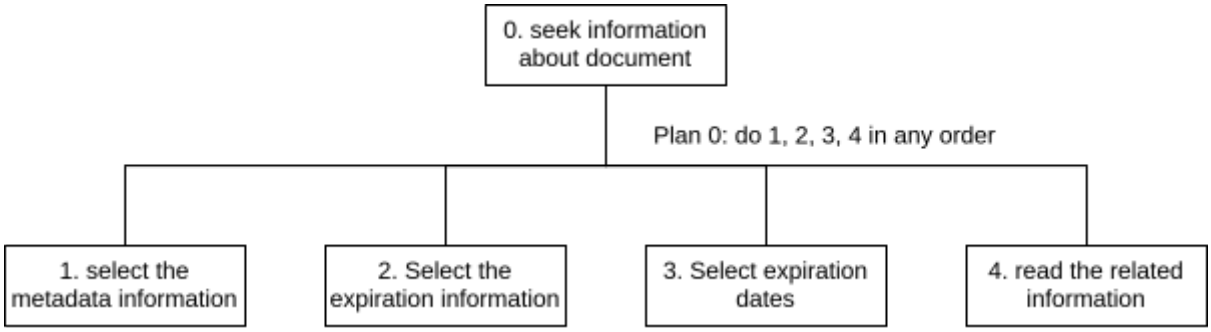



Figure 16: HTA for the requirement View documents list

### 4.1.5 Edit an existing element

This task allows the users to view all uploaded documents using the filters to adjust the search. It is possible to look for the metadata information, document information, and expiration dates.

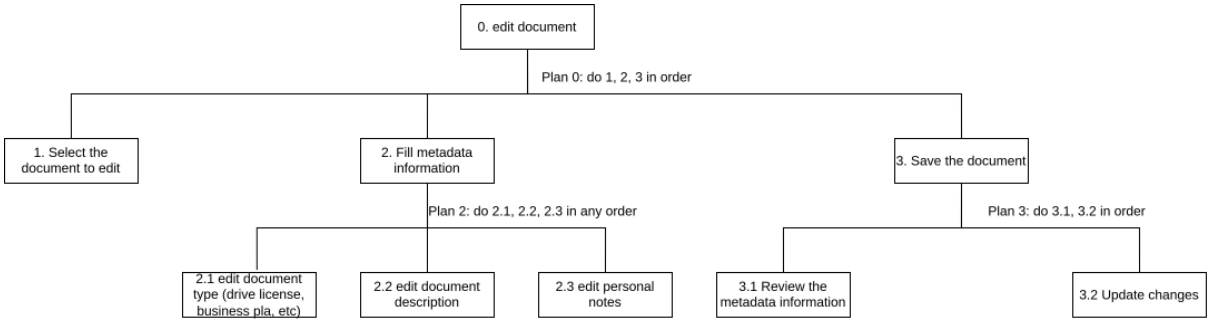



Figure 17: HTA for the requirement Edit an exisisting element

### 4.1.6 Remove document

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

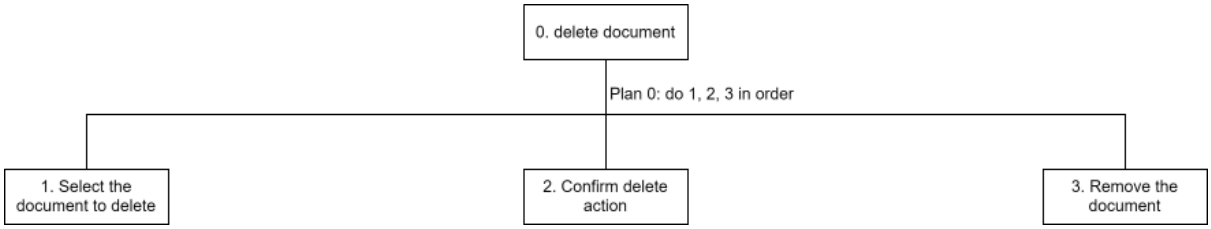



Figure 18: HTA for the requirement Remove documents

## 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 o scan it using the smartphone camera, add the document metadata, and adjust the expiration settings.

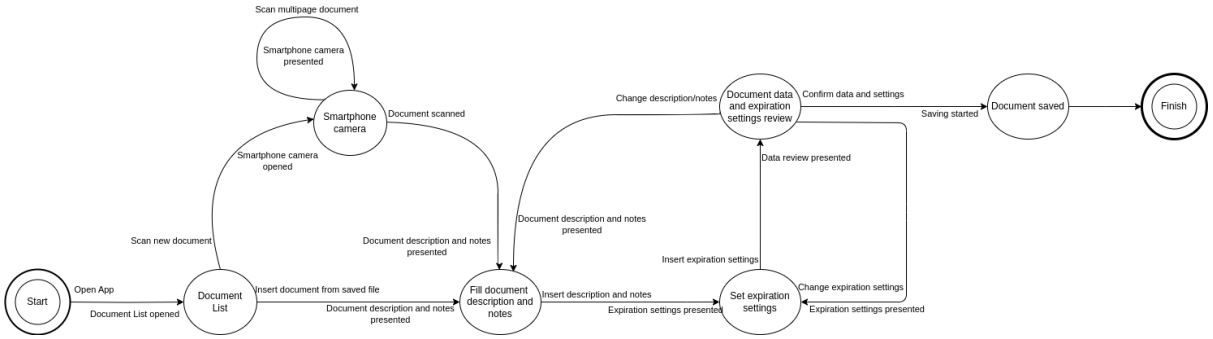



Figure 19: STN for add new document

### 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.

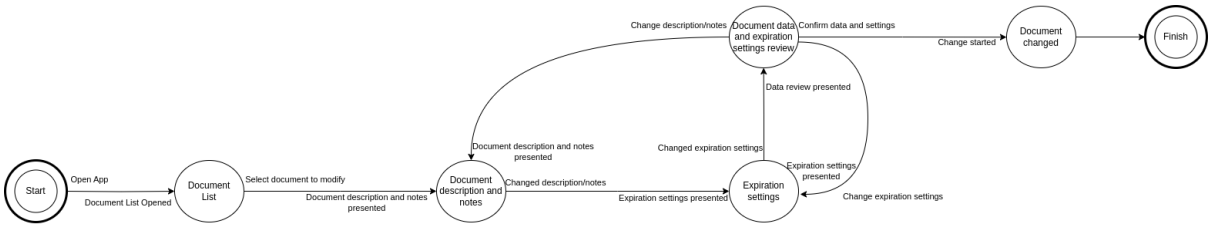



Figure 20: STN for edit document

### 4.2.3 Remove document

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

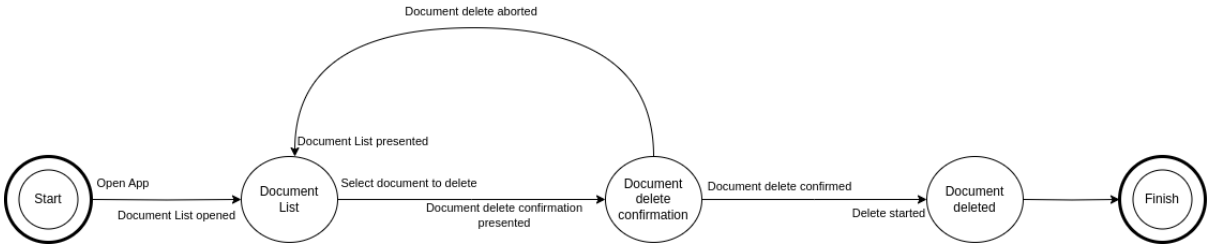



Figure 21: STN for remove document

### 4.2.4 View document list

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

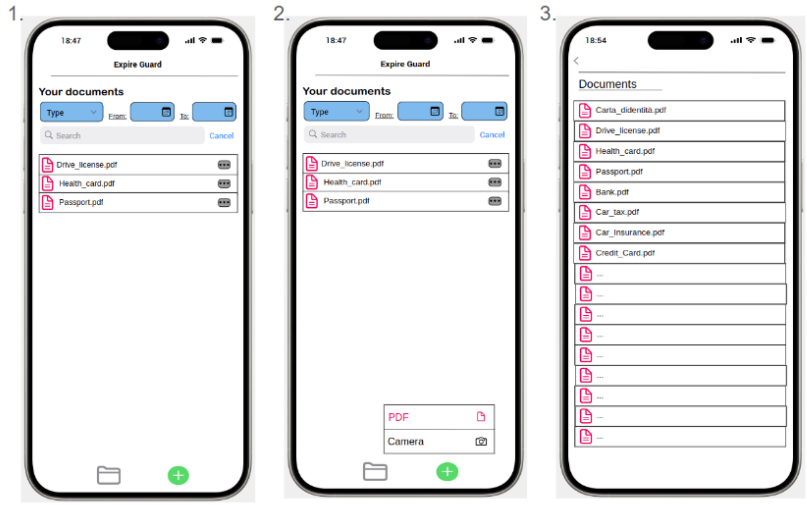

Figure 22: STN for view documents list

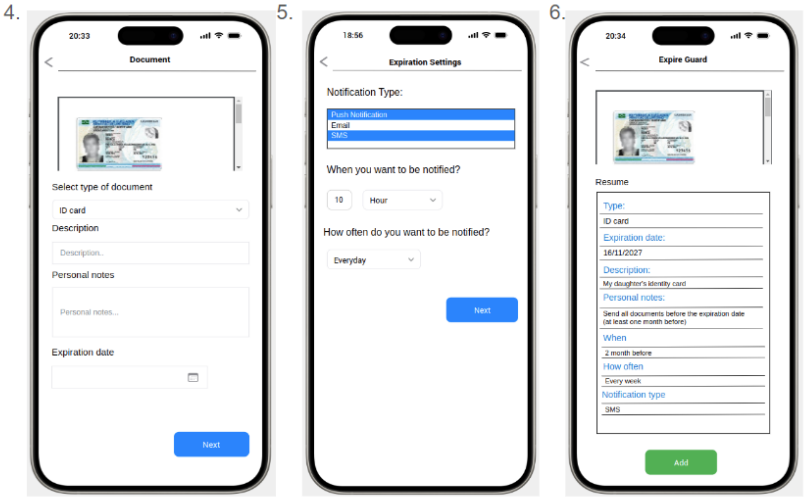
# 5 Prototype Zero

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.



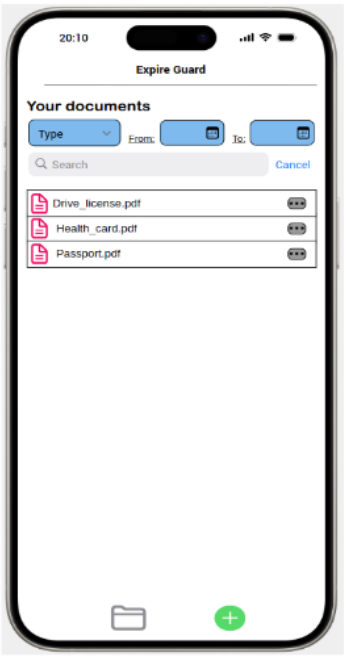
## 5.2 Add document using camera scan

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's. It also shows the presence of various filters on the document archive page to perform a custom search of saved documents.

1.

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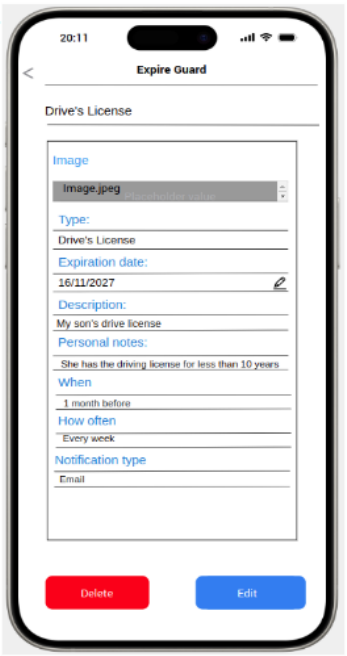
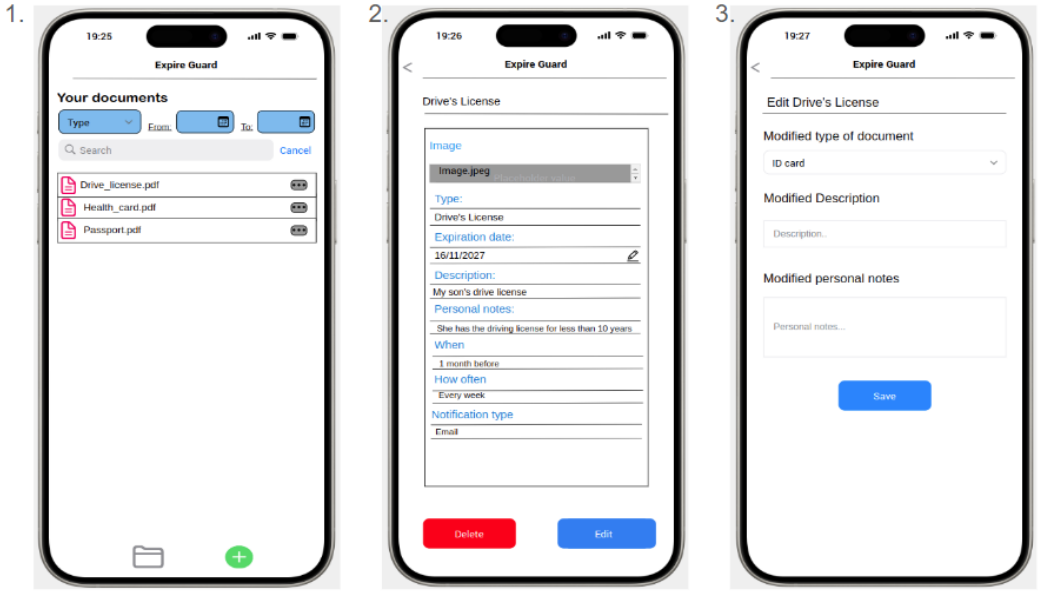


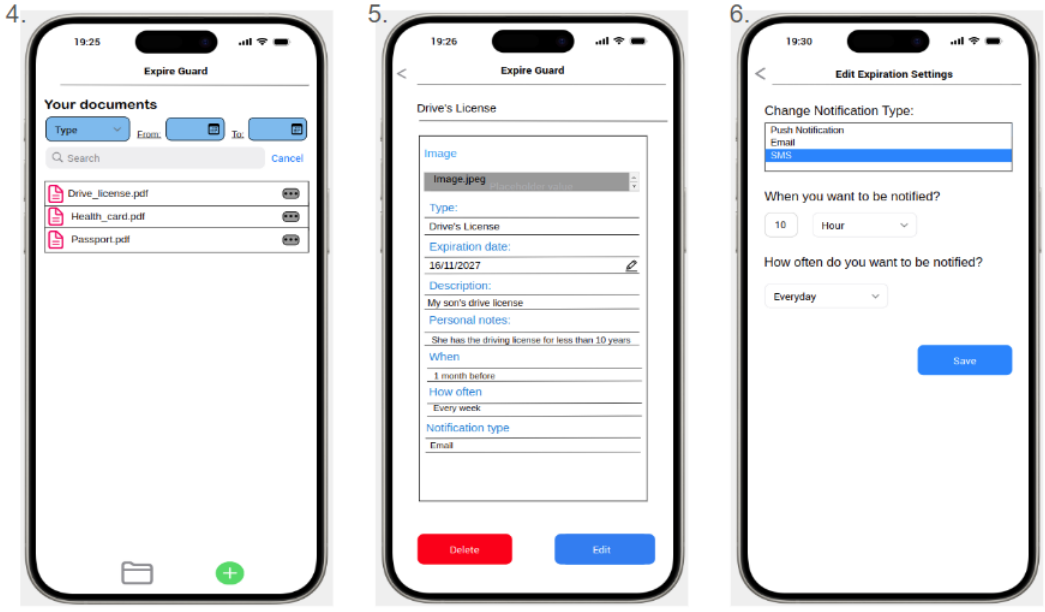
## 5.4 Edit document description and personal notes

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



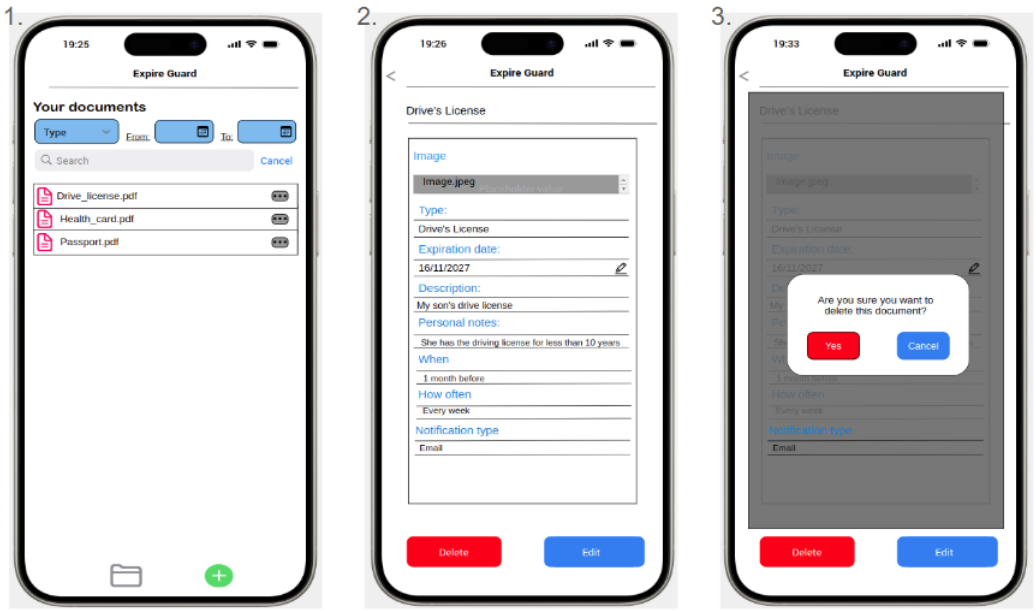

## 5.5 Edit document Expiration date and Expiration Settings

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:

- The Edit Document metadata page and the Edit Expiration Settings page are merged in a single page to help users avoid errors and facilitate the learning process.
- The fields relative to Document's Description and Personal Notes are unified to improve the user experience making it more understandable.
- Some labels are changed to improve readability and understanding for new users.
- Improved our choices of input types and buttons to make user interaction with the system a more pleasant experience aimed at mobile devices.
- Added a new editable field relative to the Document's name called "Name".
- 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

As mentioned at the end of the previous sections, the improvements led us to develop Prototype One of Expire Guard. This time, we decided to create an interactive prototype of our design, as it will play a crucial role in the upcoming user-based evaluations. Below is the link to the interactive prototype, which can be viewed and explored to understand the differences from the mockups and see how it was enhanced based on the experts' suggestions:

Prototype One

# 8 User Based Evaluation

Following the expert evaluation, we have addressed the majority of the usability problems. It is now time to return to the users for an evaluation based on their feedback. We will conduct an evaluation involving the target users of the system. User-based evaluation techniques include various methods, each with its advantages and disadvantages. The most commonly used techniques are Think Aloud and Controlled Experiments. Therefore, we have decided to implement both.

## 8.1 Think Aloud

The Think Aloud method is based on simple principles. We gathered a group of seven people, presented them with our prototype, and conducted the experiment using the following criteria:

1. We introduced ourselves, explained the purpose of our application, and outlined the goals of our evaluation.
2. Each participant was asked to individually complete the same task: add a document and then edit it.
3. We clarified that we were testing the application's design, user-friendliness, and usability, not the participants themselves.
4. The experiment took place in person, with each participant using Prototype One of Expire Guard.
5. During the tasks, we asked participants to explain their actions, thoughts, and any doubts they had out loud.
6. We took notes with pen and paper, which were later refined in Microsoft Word.

We chose these tasks because they represent the main functionalities of our application. The participants included university students and adults with varying levels of experience with smartphones and mobile applications, all fitting the age range identified in our user requirements.
The results were very positive:

- Participants found the user interface easy and intuitive.
- They easily located the 'add document' feature and navigated the adding wizard without issues.
- They then proceeded to the document's detail page, edited the document, and saved it without hesitation.

None of the participants encountered problems completing the tasks, indicating that the graphical interface effectively guided users without causing misunderstandings or confusion.

Given the positive outcomes, we asked participants for feedback on their experience and any potential improvements. Only one participant made a suggestion: when adding a document via camera scan, he preferred to scan the document first and then fill out the form, rather than the sequence in the prototype.

## 8.2 Controlled Experiment

A controlled experiment is a method where the environment under test is kept constant, except for one variable. Typically, a state of the system is designated as the control group, usually representing the normal or standard condition. Another group, the experimental group, is then compared to this control group. All conditions between these two groups are identical except for the one variable being tested.
In a controlled experiment, every aspect of the environment is maintained to ensure that only the variable being examined can change. This allows researchers to measure the specific effects of that variable accurately. The goal is to isolate the variable's impact, providing clear and measurable data on how it influences the outcome.
Controlled experiments are considered the most rigorous empirical methods available. They provide strong evidence to support or refute a particular claim or hypothesis, as they minimize the influence of external factors and focus solely on the variable in question.By maintaining strict control over experimental conditions, controlled experiments ensure that the results are attributable to the variable being tested, making them a powerful tool in empirical research.

### 8.2.1 First experiment

We used this tool to help us decide between two different solutions for our graphical interface. Specifically, we examined the alternatives shown below. In the first option, we used an icon to represent the button that allows users to go back to the previous page. In the second option, we used a hyperlink with the text "Go back to resume page." These two alternatives serve as our independent variables in this comparison.
By evaluating these two design choices, we aimed to determine which one provides a better user experience. The icon-based button offers a visual cue that is often quickly recognized by users, while the text-based hyperlink provides a clear and direct instruction. Our goal was to see which approach users found more intuitive and efficient for navigation.

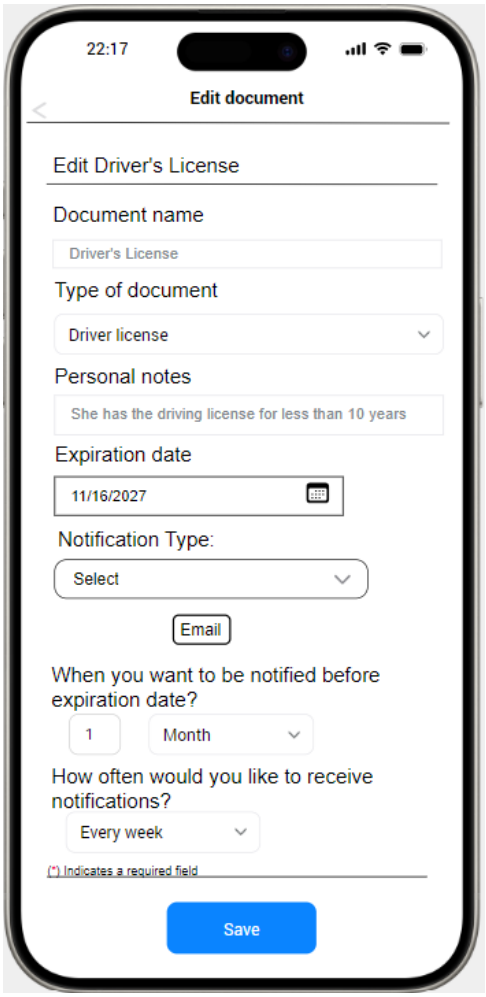



Figure 23: Original version, called "icon"

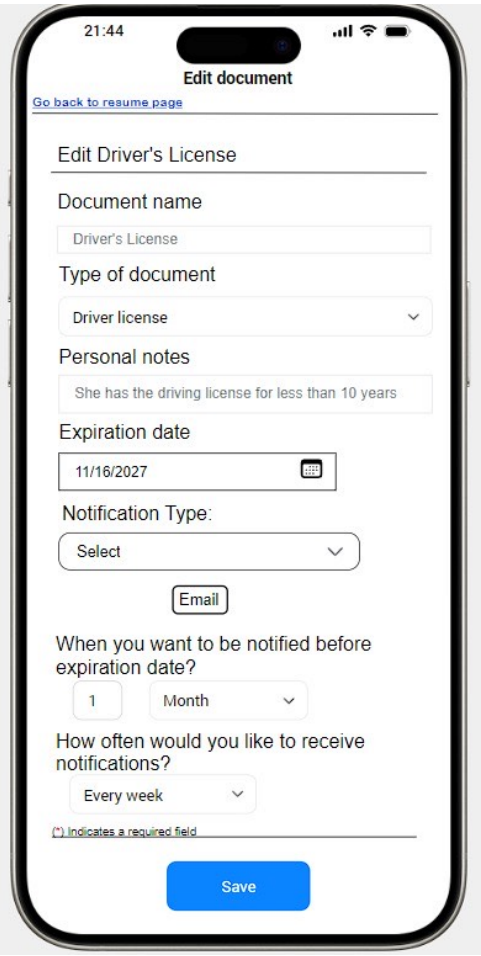



Figure 24: Alternative version, call "text"

With our experiment underway, we defined the following hypothesis: users will make fewer errors with the version shown in Figure 23 compared to the alternative version in Figure 24. As is standard practice, we also established the null hypothesis: there will be no significant difference between the two versions in terms of errors made. The dependent variable we measured was the number of errors participants made while completing the task of editing a document.

We recruited a total of eight participants within the user range specified in previous sections. Each participant was tasked with editing a document, and we employed a within-group method, meaning every participant tested both versions of the interface. This approach helped eliminate bias and reduced the number of participants needed. However, it also introduced the possibility of transfer of learning, where experience with the first version could influence performance on the second.

To mitigate this factor, we had four participants start with the first version and then switch to the second, while the other four participants started with the second version and then switched to the first. This counterbalancing method helped reduce the impact of learning transfer, ensuring that our results were more reliable and reflective of the true differences between the two interface versions.

### 8.2.2 ANOVA

Following the experiment, we obtained eight values representing the errors made by participants for each version.To interpret the results, we will conduct a statistical analysis aimed at disproving the null hypothesis and identifying the optimal version. We employed ANOVA (Analysis of Variance) for this purpose, a statistical method that evaluates variance using the F-test. This analysis can be conveniently performed using Microsoft Excel.

| Icon | Text |
|---|---|
| 0 | 0 |
| 0 | 1 |
| 0 | 0 |
| 0 | 1 |
| 0 | 1 |
| 0 | 1 |
| 1 | 0 |
| 0 | 1 |

Anova: Single Factor

SUMMARY

| Groups | Count | Sum | Average | Variance |
|---|---|---|---|---|
| Icon | 8 | 1 | 0,125 | 0,125 |
| Text | 8 | 5 | 0,625 | 0,267857 |

ANOVA

| Source of Variation | SS | df | MS | F | P-value | F crit |
|---|---|---|---|---|---|---|
| Between Groups | 1 | 1 | 1 | 5,090909 | 0,040569 | 4,60011 |
| Within Groups | 2,75 | 14 | 0,19643 | | | |
| | | | | | | |
| Total | 3,75 | 15 | | | | |

Figure 25: Anova computation of the first experiment

Since our analysis showed $F > F\ crit$, we can reject the null hypothesis and use this evidence to support the conclusion that the first alternative is more intuitive than the second. This result is likely due to the icon being commonly associated with returning to a previous page without completing the current task. In contrast, the hyperlink text may cause confusion, especially among users in the older age group or those less familiar with smartphones and mobile applications.
When these users see the hyperlink text in the upper left corner upon opening the page, they might mistakenly believe it is where they should click after completing the task, such as editing the document in this case.

### 8.2.3 Second experiment

Our second experiment aimed to determine whether we could create a better and more intuitive version of the main page of our application. Specifically, we investigated whether adding text to the button for the "Add Document" feature would enhance our design. These two alternatives will serve as independent variables in this comparison.

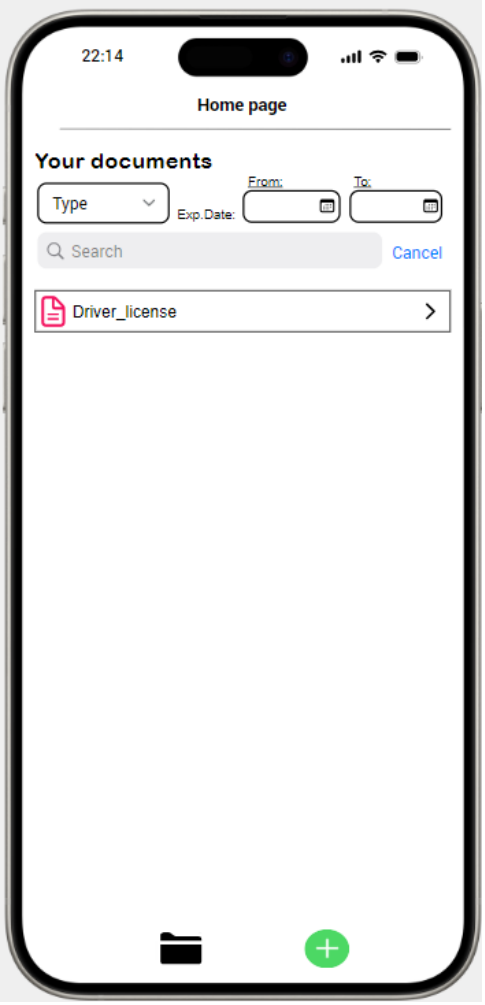



Figure 26: Original version, called "+"

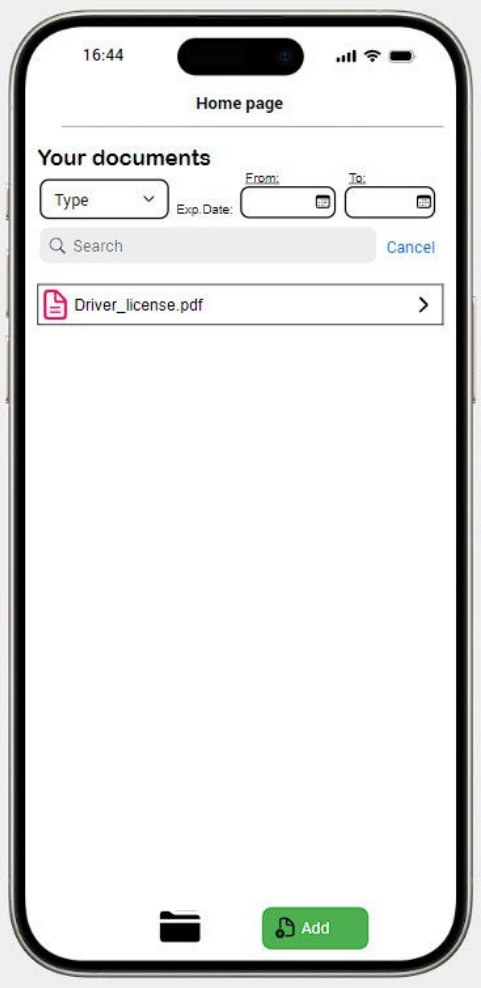



Figure 27: Alternative version, call "add"

We now define the following hypothesis: the version shown in Figure 25 will lead users to operate more quickly than the alternative version shown in Figure 27. As usual, we also define the null hypothesis: there will be no speed difference between the two versions. In this case, the dependent variable we measure is the time taken by subjects to complete the task of adding a document. The experiment is conducted under the same conditions as the first experiment.

### 8.2.4 ANOVA

In this case, we obtained a series of eight time values (measured in seconds and rounded up to the nearest integer) for each version. As previously mentioned, we will now conduct our analysis using the ANOVA statistical technique.

| "+" button | "Add" button |
|---|---|
| 94 | 105 |
| 99 | 97 |
| 89 | 95 |
| 94 | 101 |
| 92 | 87 |
| 90 | 95 |
| 88 | 91 |
| 91 | 98 |

Anova: Single Factor

SUMMARY

| Groups | Count | Sum | Average | Variance |
|---|---|---|---|---|
| "+" button | 8 | 737 | 92,125 | 12,41071 |
| "Add" button | 8 | 760 | 95 | 18,57143 |

ANOVA

| Source of Variation | SS | df | MS | F | P-value | F crit |
|---|---|---|---|---|---|---|
| Between Groups | 33,0625 | 1 | 33,0625 | 2,134294 | 0,166115 | 4,60011 |
| Within Groups | 216,875 | 14 | 15,49107 | | | |
| Total | 249,9375 | 15 | | | | |

Figure 28: Anova computation of the first experiment

The statistical analysis of the second experiment resulted in $F < F\ crit$ indicating that we must reject our hypothesis and accept the null hypothesis. This suggests that changing the button to the alternative version will not improve our design. This is likely because the "add document" feature, being the main function of the application, is already sufficiently highlighted and easy to understand in the current design we developed.

## 8.3 Gatherings

At the end of the User-Based Evaluation, we confirmed that the steps taken following the Expert Evaluation were effective. There were no issues during this phase, and the general satisfaction of the users demonstrated that the interface design is both easy and intuitive for new users while efficiently supporting the tasks it needs to accomplish. It provides all the necessary tools for users to set custom reminders for document expiration dates.
We decided not to follow the suggestion from one user to change the order of the pages in the 'add document with camera scan' feature, as this feedback was unique to a single participant. All other users found the existing design to be optimal.