



User Interface technology generation upgrade - From static monolith to dynamic evolution

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2021 Laurea



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Business Information Technology  
Thesis  
June, 2021



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USER INTERFACE TECHNOLOGY GENERATION UPGRADE - FROM STATIC MONOLITH TO DYNAMIC EVOLUTION

Year	2021	Number of pages	49
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The purpose of this thesis project was to design a new interface for the CRM software application at the client company, TietoPiiri. The objective was to produce a software interface that would have a user-friendly and modern design.

The theoretical framework was based on a literature review of user interface and user experience design. In addition, interviews were conducted with the users of the software. Design conventions were followed to create an optimal user experience, and user interface for the new software version. Besides recreating and optimizing features, the author also introduced new features such as modals, filters, sortings, tutorials, among others.

The project results were a completely new design for the software, satisfying the clients and the company. Using modern technologies and standards, the author also created mobile compatibility for the software, which was very poor before. In summary, the thesis report covers the theoretical framework, the methods used to interview the clients, and an outline of the development strategy and outcomes.

Keywords: UI, UX, Design, software development

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## 1 Introduction

The client has a monolith Java based charity CRM service. The early millennium architecture needs to be revised to provide a clear interface between the backend and front-end. In the same instance, a new React-based front-end and UI need to be developed from scratch.

"The service has been developed for more than 15 years. Thus, it has to be upgraded in pieces."

Some research was already done for the donation forms (these are external forms provided in API form) that the company provides for their clients. Furthermore, a small sample of the current development was shown to the clients amongst a few placebos for the clients to vote their favourite, and the majority selected our sample. Incremental research will have to be conducted during the thesis process. In the future, the clients will be interviewed, and deeper research will be implemented in the final version.

## 2 Company Presentation

TietoPiiri Oy, a family business founded in 1974, is a leading non-profit organization (NPO) donor and volunteer management (a CRM) solution provider in Finland. Since 2000 they have provided their TP FONS service on-line. The current service is in its 4th Generation, yet it carries over monolith Java architecture of JSP-pages based UI that is end-of-life and harming future business. The company's key development program is implementing next-generation TP FONS that breaks the monolith structure and implements the clear interface between Java-based backend and React based front-end, enabling separated technology refresh cycles.

### 2.1 The problem to be addressed

According to modern standards and technologies, it is necessary to upgrade the front-end of the company's main service. At the same time, maintain the service's essence so that the clients do not struggle with the new version. Moreover, consider the wants and or suggestions of the clients of the company. Also, research to make an appealing and, most importantly, good user experience and interface.

Research question:

"How to improve the UI and UX of the service, making it user and mobile-friendly, without losing the essence of the service?"

This compound question will be the core of the research process.

## 2.2 Objectives and Outcomes

### Key Objectives

- Research the theory of what makes a good User Interface (UI) and User Experience (UX)
- Implement findings and create User interface and User experience solutions
- Create the structure and guidelines for the graphic interface upgrade for the company.
- Start upgrading the User Interface and User Experience of the companies' software.
- Analyse which features are essential, where to improve and what to remove to ease the clients lives.

### Expected Outcomes

- Have an initial structure of the new User Interface for the rest of the application to be built upon.
- Weighted interview outcomes of users' UI needs and expectations (pros, cons, expectations, prioritization)
- Get insight on customers views and needs.
- Innovate the software and create new helpful and useful features.

## 3 Theoretical frameworks

### 3.1 Good User Experience

When it comes to achieving a great user experience, the main point is meeting the customer's exact needs while keeping it simple and elegant, creating a product that the customer enjoys using. Authentic user experience is more than just giving clients what they think they want or just listing potential features. Creating a good user experience involves seamlessly merging the company's services, graphic, and interface designs. (Don Norman, Jakob Nielsen, 2012)

The User experience(UX) has to be differentiated in the design. UX is not just a part of UI but a part of the whole interface.

According to Jakob Nielsen (2012), usability is a quality characteristic of the user interface, measuring how easy it is to learn, how efficient it is to use, the "feel" of the design, and other similar measures.

### 3.1.1 Definition of usability

Usability is a quality attribute that evaluates the difficulty level of use of user interfaces. The word usability in itself also applies to the improvement process during the design phase.

Doctor Jakob Nielsen advocates that five main quality components can define usability:

- 1 - Learnability (This component identifies how easy it is to realize basic tasks the first time they use the interface).
- 2 - Efficiency (This component measures how long it takes users to perform a task after they have learned the design)
- 3 - Memorability (This component verifies how hard it is for a user to restore his useability after a long period of not using the design).
- 4 - Errors (This component analyses how many errors happen when using the design, how severe they are, and how easily recoverable they are).
- 5 - Satisfaction (Arguably the most essential component, it measures how satisfying it is to use the design).

There exist many quality components to consider when designing. However, usability is present all over the interface, so it should be paid attention to. Does a design provide what users need? - Is the main question to be evaluated when addressing the utility of a design.

Usability and utility are evenly essential, and both determine if something is useful. When designing, it is pointless if a task is easy to realize if it can not do what the user wants. Also, it is not good if the system can do what the user wants, but it is too difficult to do it because the interface is overcomplicated.

*"Definition of Utility = whether it provides the features you need.*

*Definition of Usability = how easy and pleasant these features are to use.*

*Definition of Useful = usability + utility." - Dr. Jakob Nielsen*



### 3.1.2 Importance of usability

Nowadays, usability is a critical factor for the success of an application. If a website or app is challenging to use, a likely scenario is that users stop using it. If it is not clear what the product offers and what users can do with the product, users move elsewhere. If information is difficult to read or does not provide answers to the users' questions, users leave. More often than not, users do not read manuals or study to use an application, as there are plenty of websites and applications.

"Current best practices call for spending about 10% of a design project's budget on usability. On average, this will more than double a website's desired quality metrics (yielding an improvement score of 2.6) and slightly less than double an intranet's quality metrics." - Says a study by Norman Nielsen Group (NNG)

It is good to double the usability for internal design projects as this can potentially cut training times significantly, which might translate into financial savings.

### 3.1.3 Improving Usability

One can go about many ways to study usability, but one of the most reliable and valuable is user testing, which consists of three main components:

- Select the study subjects.
- Ask them to perform representative tasks.
- Observe what the subjects do.

Following these guidelines provided by the Norman Nielsen Group, the study subjects were TietoPiiris' clients. They were initially asked what could be improved and what they already liked about the current service to gather an initial idea of the strategic plan for the design process.

After gathering qualitative data, collecting feedback, initial sketches were made, and preliminary versions of the new service version. For the final stage of the study, once the new version upgrades were presented, the observer had the opportunity to observe how the users were using the old version of the service and where they struggled and used those

observations to optimize usability in the new version. Further details of this study will be in the development section of this thesis.

To further increase the study's success and gain a deeper understanding of key areas to work upon, users should be tested individually. It might and probably will alter the study results by helping users or direct their attention to any specific point.

Don Norman, an expert who works in a world leader research-based user experience company, believes that it is enough to test five users to identify the principal usability problems. The reasoning behind this is that it is much more cost and time-efficient to run many small tests, getting the opportunity to improve the design in between tests and fix flaws as they get identified.

Iterative design is presumably the most dependable way to increase the quality of the user experience. The more versions of interface designs that get tested with users, the better.

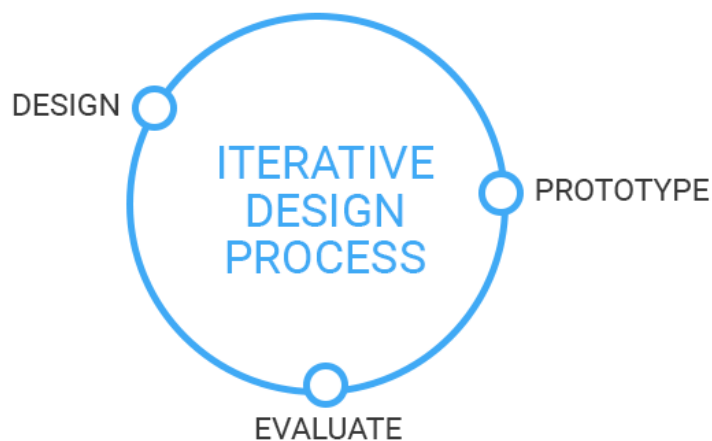


Figure 1 - Prototyping process (JustInMind,2020)

Usability has a massive role in every step of the design process. Here are some key steps that experts from Norman Nielsen Group recommends:

At the start of a new project, it is essential to analyze and identifying the valuable elements that should be kept and identifying the elements that should be removed to improve the design use.

- Compare your design to other similar successful designs to get inspired.
- Analyze how users usually behave.
- Sketch initial versions of the design and test them. It is ideal for saving time to be able to try more options based on the results of the tests.
- Optimize the design step by step, gradually getting to final high-end versions.

- Once the final design is implemented, test it again. Slight usability problems always sneak in during implementation.
- To obtain a high-quality user experience is necessary to start user testing as early as possible in the design process and make a habit to test regularly.

### 3.2 Modern graphic user interface

The UI (user interface) is a crucial part of a software product. If done correctly, the users will not even realize the quality of the product. However, if done poorly, the users will immediately realize that and struggle with it, even potentially search for an alternative product. Creating a successful interface consists of applying good design principles. The principles are concepts that are meant to orient the designers.

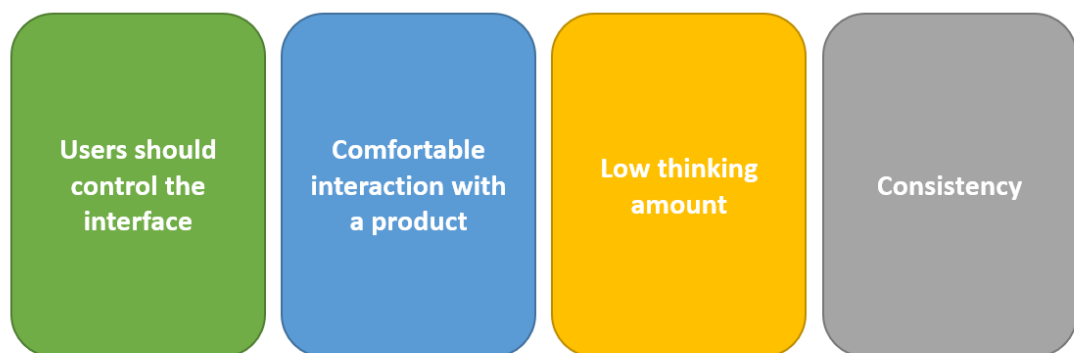


Figure 2 - The principles for a good UI

#### 3.2.1 Users should control the interface

The users of software should feel in control of the interface. Being in control makes the user comfortable. This way, they will learn fast and quickly master the use of a product.

##### Allow reversible actions

This concept suggests that a user should be able to undo a performed action quickly. If users are aware that their actions are reversible, they are prone to explore the software more confidently, consequently learning faster how to use the system. On the opposite side of the spectrum, if users have to be very cautious with each action they make, the learning curve decreases steeply, as users are afraid of making mistakes that can create tension in their user experience.

A widespread example of reversible actions is the "Undo" and or "Redo" options. "Undo" allows users to go back "step-by-step" through the actions that the user made. "Redo" allows users to reverse the "Undo". In other words, undo the "Undo". For example, if a user writes a piece of text in an editor, then clicks "Undo" by accident, and his text will get deleted, then he could click "Redo" to go back to where he was before the "Undo". It is possible to find this function in Microsoft Word, for example.

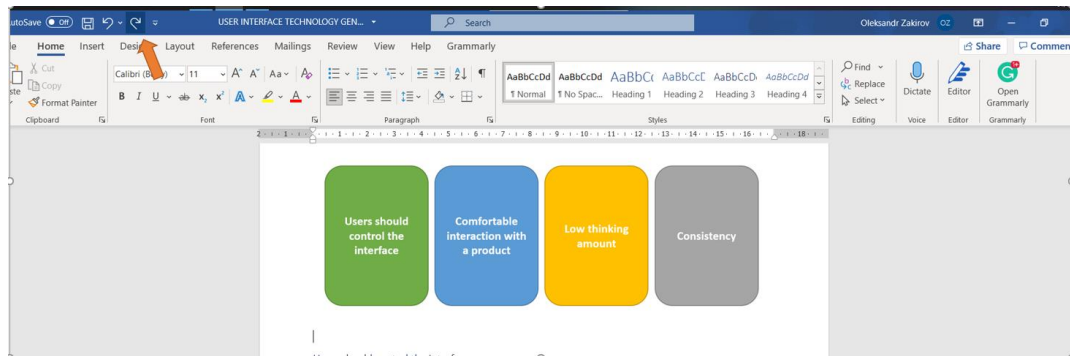


Figure 3 - Undo/Redo functionality in word

"Undo" is quite a handy feature. However, it can have much more impactful use. If a user chooses a wrong system function by mistake, the ability to reverse that action can be crucial. This function will allow a user to return to the previous state if that is what the user wishes. An excellent example that anyone can relate to is Outlook's notification message when an email gets deleted.

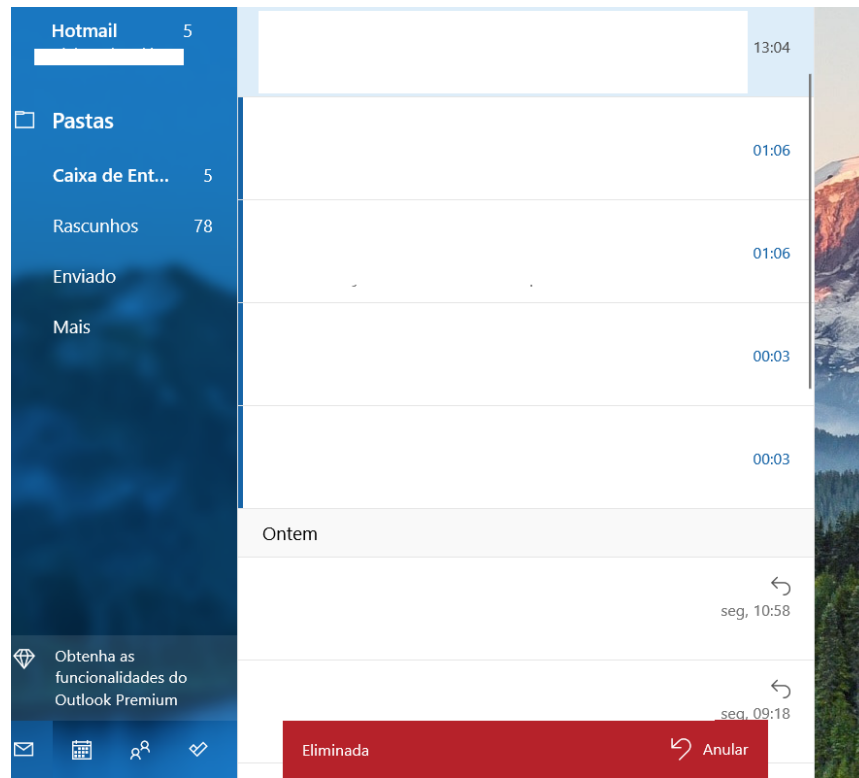


Figure 4 - Undo message in red in Outlook

### Easy-to-navigate UI

The navigation has to be explicit and intuitive. The user should not struggle to reach a page or a view in any software. The users' journey should be as easy and enjoyable as possible. Even in cases where a company has highly complicated products, the users should not be overwhelmed or intimidated to the point that they get afraid of pressing a button. Well-designed interfaces make users comfortable by presenting some context of which page they are located in, where they came from, and where they could go next. It is a good practice to consider a few key factors to improve the navigation within the software, such as:

### Visual hints

Visual hints work as suggestions for users. By presenting points of interest, hints help users to navigate an interface easier. Good hints are page titles, highlighting the currently selected navigation options, and other hints that facilitate the user to understand which part of the interface he is located. Users should not be questioning themselves about where they are or how they got there.

## Intuitiveness

User should get hints that facilitate them to predict the result of an action. Users should not be questioning themselves where they have to press to realize their task or what does a particular button does.

The image shows a checkout interface with a progress bar at the top. The progress bar has four steps: Delivery, Confirmation, Payment, and Finish. The 'Payment' step is currently active. Below the progress bar, there are two payment options: 'Pay £340.00 with credit card' (selected) and 'Pay £340.00 with PayPal'. The credit card option includes fields for Cardholder's Name, Card Number, Valid thru (MM/YY), and CVV/CVC. A 'Back' button is on the left and a 'Next Step' button is on the right.

Figure 5 - Workflow (DesignModo, 2020)

## Informative feedback

In this case, information feedback refers to points of action. For each action that the user makes, the system behind the interface should ideally show purposeful and clear feedback. A system that gives regular feedback allows users to realize their tasks more assertively.

When designing an interface, it should be considered the sort of interaction. For example, repetitive and frequent functions can have more modest feedback. On the other hand, when users interact with an object (for example, a button), it is essential to indicate that an action was performed by said button. A typical example of this can be found when a person clicks on a button, and it changes its color once it's pressed, pointing that interaction has occurred. The absence of this type of feedback may leave users in doubt if their intended actions have been performed, forcing the user to double-check if, in fact, the action was performed.

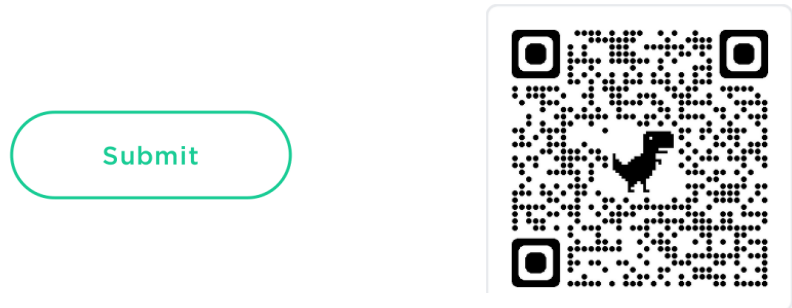


Figure 6 - Submission button giving visual feedback (Colin Gavin, 2019)

(Scan QR code with phone to see gif if reading thesis in paper format)

For occasional cases, yet important ones, the feedback has to be more substantial. An example of this case is when filling a password field in a signup form. A good user interface would inform the user of the requirements for the password.

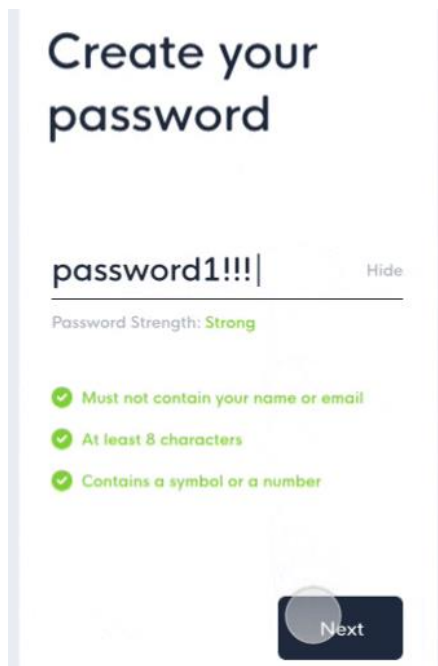


Figure 7 - Checked met requirements - (Emanuel Torres, 2020)

## Status visibility

Users tend to be more satisfied when provided with information about what is happening and the status of a process. Creating a visual feedback status is extremely helpful when users start doing an action that takes a while to be computed. It is not suitable for the user not to be able to see anything on the screen while a program or application is supposedly doing something. A practice such as using progress indicators is an easy and forthcoming way to avoid this problem, improving the user's experience.

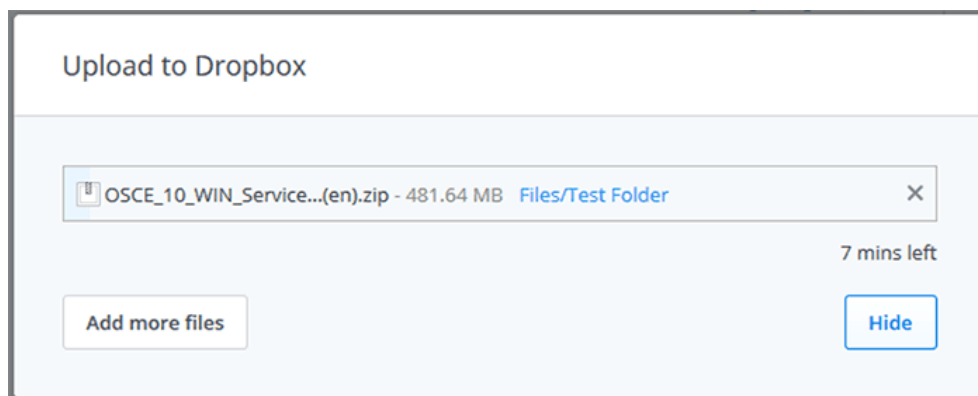


Figure 8 - Dropbox loading bar

Overlooking this subtle feature might create discomfort for the users unnecessarily. A good interface comforts users, informing them about the progress of a task while the computer is performing it. Dropbox is an excellent example of how and when to use this feature.

## Comfortable interaction with a product

An important rule when it comes to creating a design is to get rid of unnecessary elements that are not helping users. An interface should include only information that is relevant and frequently required. Having only relevant information keeps the interface clean and fresh and points the user to the valuable parts of the UI instead of complicating the process. It is necessary to avoid complicating the design by adding unnecessary content that does not add value or support the users' tasks.

The interface should not be designed in a way that presents useless and irrelevant information on the screen. All elements should be evaluated based on the value that they create for the users. An example that follows these simple approaches and expresses these concepts very well is Grammarly.



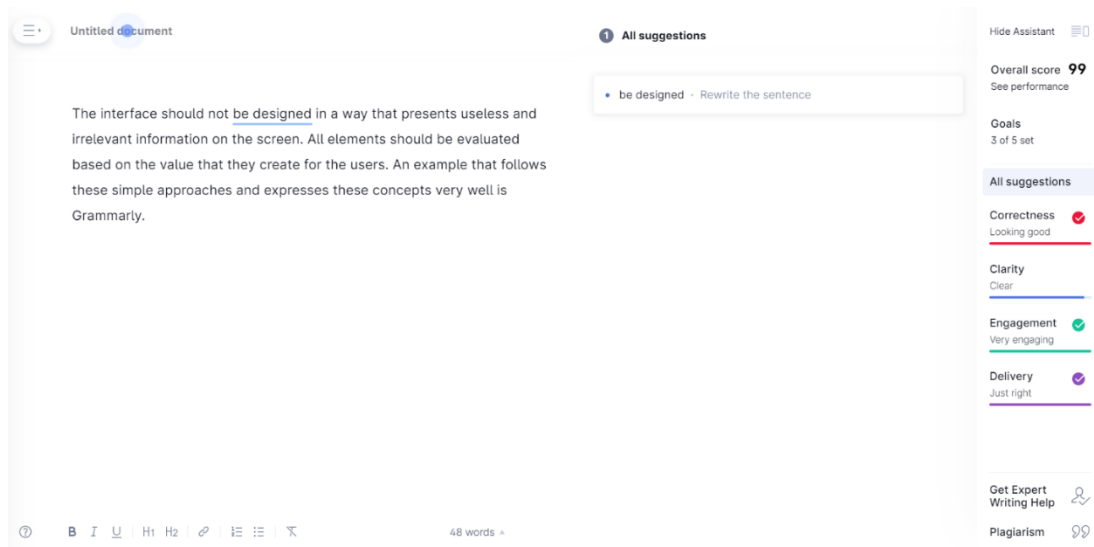


Figure 9 - Grammarly Interface

#### Ask only new data

Users should not be forced to type the data that they have already provided before. Users do not get happy about dull data-entry sequences, mainly when they have already entered the data before. An intelligent interface makes the best use of information while requiring the least quantity of information from users.

#### Use simple language

Sometimes developers and designs forget that regular people (users) do not speak technical language. It is best to use common and easily understandable language. Designers should focus on the language used and avoid system-oriented terms. The interface should have concepts, phrases, and words that are familiar to the users.

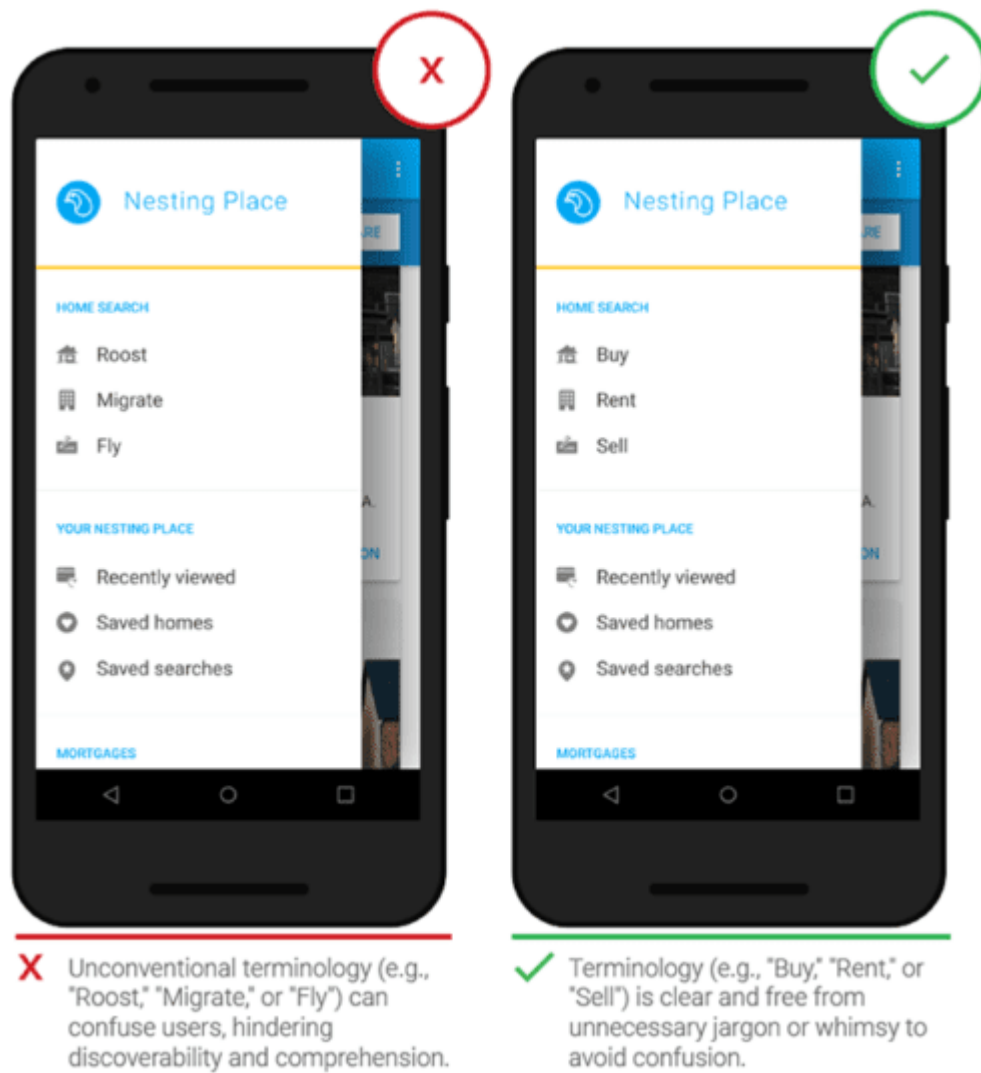


Figure 10 - Correct terminology (Google)

#### Fitts's Law

"Fitts's Law describes how long it takes a user to hit a target in a graphical user interface (GUI) or other design, as a function of size and distance. Understanding this law helps us design better buttons, forms, lists, and other interactive elements." (Lexi Kane, 2020)

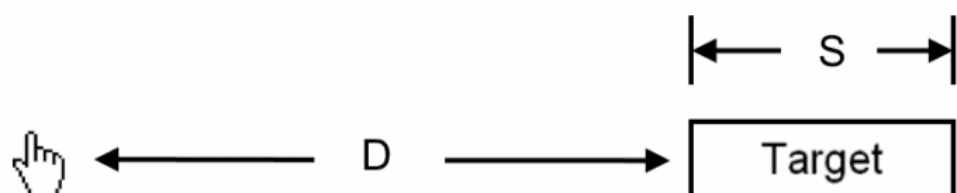


Figure 11 - Fitts law (D=distance, S=size)

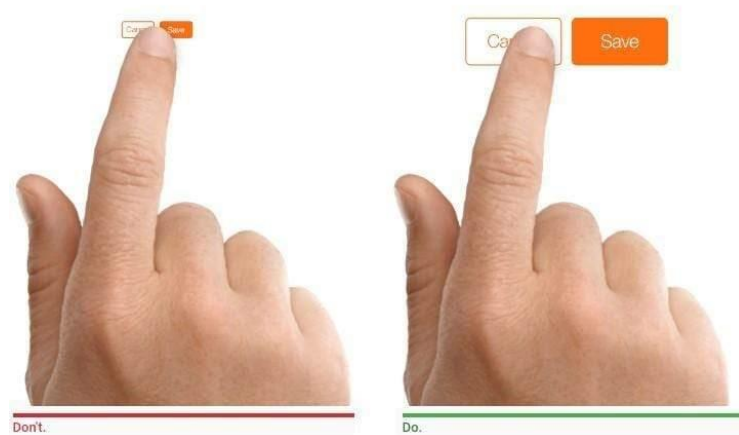


Figure 12 - Sizing (Apple)

Another vital point to consider is that the amount of time necessary to hit multiple targets is the total time to hit each. So, when designing the interface, the distances between targets should be reduced, and the target sizes should be increased. This convention will increase the interactions' efficiency. Also, the number of targets that the users have to use should be aimed to be as minimal as possible.

### Accessibility

Every designer should remember that a product has to be designed with users of all abilities in mind, including people with impairments such as vision, hearing, cognitive, or motor, among others. So that all users have good accessibility. An interface to be considered good should have good accessibility, as a good interface is enhanced to be usable by several groups of users.

Color is an excellent example of one of the elements of a UI that immediately impacts the accessibility of the software. People have different perceptions of colors. Some people have a limited range of colors that they can see, while others can see the whole range. According to the research conducted by the Norman Nielsen Group, about ten percent of people have at least some form of color blindness. This should be considered in the designing process, and consider using more than just colors for the only way to convey information. When it is desired to use color to convey information, there should also be text or other hints to convey information to those who have impairments.

### Metaphors

Metaphors are a great way to build connections between the virtual and real world. By not using real-world metaphors, the design dramatically misses out on the opportunity to

empower users by enabling them to use logic and knowledge from real examples in real life while at the same time making the interface more intuitive. The primary purpose of a metaphor is to transfer the familiarity that the user has in the real world to the virtual side. An example of this is the recycling bin on every desktop. Logically it is not an actual bin. However, it is graphically presented in a way that increases the intuitiveness of what is its purpose.



Figure 13 - Recycling bin windows metaphor



When on the deciding stage of a metaphor, an evident metaphor that will clearly create an association with the user and the real world is the best choice. For example, when card details are requested in payment forms, a credit card metaphor can be used to add a real-world connection.

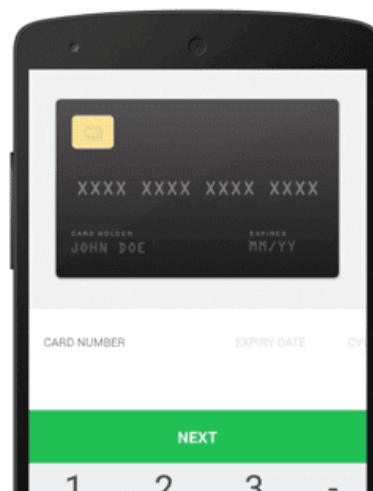


Figure 14 - Credit card metaphor (Ramakrish, 2020)

## Error handling

It is inevitable that, at some point in time, errors will occur. Poor error handling and ambiguous error messages are a quick way to frustrate the user and potentially make them leave an application. Creating clear messages with meaningful information about dealing with an error is a great way to transform the user's perspective on the application. To improve error handling, the designers can combine the error notification with tips to solve the error. Politeness, precision, and valuable error messages are the key to good error handling in an interface.

The best-case scenario is if the error does not happen in the first place. Designers should aim to eliminate potential vulnerabilities in the design that are prone to errors and test the systems regularly in order to prevent as many errors as possible. Also, when an error eventually happens, it would be great if the error itself gets prompted in a dialog box before users realize the action. For example, Google's Gmail service notifies a user if it detects keywords such as "attachment" and does not have a file attached. Gmail notifies the user that there is no file attached and asks if the user wants to proceed.

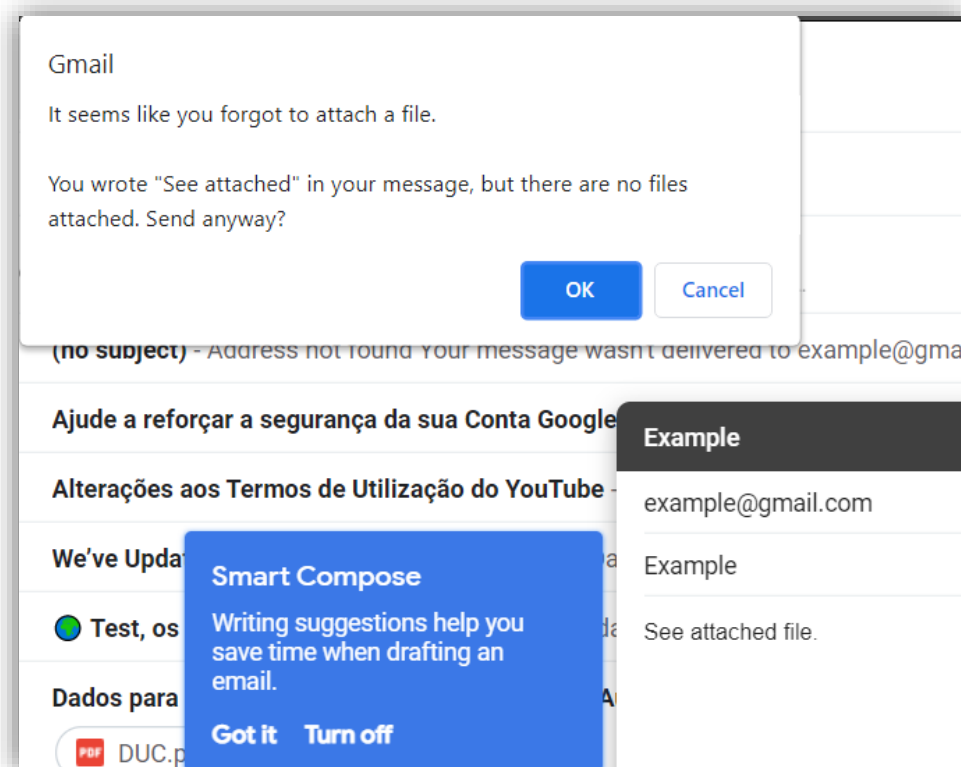


Figure 15 - Gmail error prompt

Exemplary interfaces provide exceptional error recovery for the users. They also prevent errors from happening in the first place, within possibility.

### Saving progress

Users should be able to recover their work even if they make a mistake on their side, for example, refreshing a webpage with a half-filled form. The designers should ensure that the data that users might need should not ever become unrecoverable. Many things can happen that lead to the users not having time to save the data, such as the internet connection breaking or a power outage are a few examples. So, it is a helpful consideration to take when designing the interface.

### 3.2.2 Low resistance

The users should have the road of least resistance paved for them. It is ideal to have an interface that does not require users to think too hard or work too much to use the software.

### Information Processing Theory

In the mid-fifties, a psychologist named George Miller presented a new theory to the world known as chunking. This theory explains that the human brain can hold about "seven plus" or "minus two" "chunks" of information in the short-term memory while the brain processes the information. A chunk refers to a meaningful unit. It can be digits, words, even people's faces.

However, what this means in practice is that breaking something down into smaller parts is easier for the brain to process and memorize. For example, in an interface, when a phone number is necessary, having a string of characters without any spacing might result in a lot of incorrectly inserted numbers. Usually, people will not or are not able to quickly scan ten or more digits to verify if there are errors. Even the ones that do scan might get frustrated in doing so. This is the reason why many numeric fields are usually broken into smaller pieces. Fields like credit cards, or phone numbers, or id numbers.

Figure 16 - Chunking example

### Fewer clicks (3 Clicks Rule)

When designing an interface, the design should be simple and easy to use. Users should be able to execute their pretended task with the smallest amount of actions possible. A commonly known rule in software design is the three clicks rule, which states that if a user has to click in more than three places to achieve their goal, that is too many clicks. However, that rule has some severe downsides when working with complex hardware. Sometimes there is just not a way to do something without clicking more than three times. A great point from experts in the NNG group is that designers should focus more on the difficulty of the clicks than the number of clicks. However, designers should not make the user click on ten items if there is no need. (Page Lubheimer, 2019)

Guidelines to design interfaces:

- Present only necessary information at one time on the screen.
- Use the aid of grid systems to facilitate the development and avoid visual clutter.
- Built features in a way that they work as they look like.
- Use common principles of organization. Number items, group relevant things together, use headings and relevant text.

### 3.2.3 Consistency

Consistency is an absolute must for the success of an interface. Consistency translates into intuitiveness. Consistency allows users to learn an interface easier and master its use faster. Following a consistent design brings benefits by allowing users to transfer their knowledge

and skills from one side of an application to another. In many cases, even in-between applications.

### Consistent style (Graphic User Interface GUI)

Consistent style dramatically improves the users' perspective on the integrity of a product. Discrepancies in colors, sizes, icons, fonts, and any other components that an application has should never occur. If a team of people is developing an interface, designers should always consult each other when making changes and avoid changing visual styles within the product without warning to avoid discrepancies. For example, a button with the submission function should have the same style across all pages of the application.

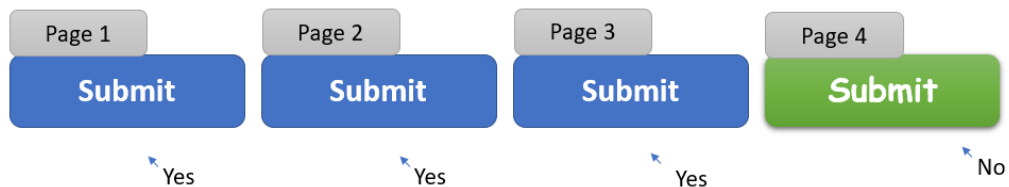


Figure 17 - Consistent style example

Changing the style of components might make the users question if the component has the same function.

### Consistent delivery

The behavior delivery of a component should be consistent. In other words, a component or object should work identically in all parts of the interface. The way that controls behave ( buttons, or menus, for example) should remain constant within the software. There is no need to surprise users with strange behavior. Users might quickly get confused when things work in different ways that they are used to. Confusion from the user side might translate into failure to learn using the interface and strip them from confidence in using the interface.

### User expectations

One of the biggest mistakes in designing interfaces is creating designs that differ from users' expectations. Because users already start using an interface with some expectations in mind. Having a justification (even a logical one) to prove how something should look or work does not matter to the user. If the user gets an unexpected feel from the interface, the



application will struggle to change the users' expectations. Unless there is a new revolutionary advantage in the design, it is best to go with what users are familiar with and expect.

#### Familiar conventions

There are a few ways to meet users' expectations. The first step to consider is following platform conventions. The software can follow the standard patterns set by big platforms. These patterns will assure to a certain degree that the application users will be able to comprehend each element in the design.

#### Do not reinvent the wheel

The great thing about designing is that there already exist solutions for many problems. Popular conventions are a familiar thing for the users. Taking this solution in most cases is more efficient than trying to create a new solution. The new solution will undoubtedly cost more resources to design and implement, and in the end, it might still be more challenging for the users. Other issues that can come up from creating a new solution might be compatibility, usability, and overall decrease user experience within the application. Even if the solution is excellent, the fact that it is unfamiliar to the users might still backfire. With all the available solutions, there is no need to reinvent the wheel.

#### Terminology

The previous topic also applies here. There is no need to reinvent the wheel when it comes to terminology. If there are already familiar terms, the designers should use them. Most users spend a lot of time on the internet and the phone, so they have much exposure to applications, web pages, and programs. They already have expectations on terminology. Going against that might create confusion for users.



Figure 18 - Terminology example

#### 4 Research methods

The University of Newcastle (2020) stipulates that there are six main research methods. Experiments, Surveys, Observations, Case studies, Literature Reviews, and interviews.

The table below gives a quick breakdown of each research method.

Methods	Purpose
<b>Experiments</b>	Test cause-and-effect relationships.
<b>Surveys</b>	Study the general characteristics of a certain number of individuals.
<b>Observations</b>	To study how something occurs in its regular setting.
<b>Case Studies</b>	Diligently understand a specific group or context.
<b>Literature Reviews</b>	Locate your research in existing work or evaluate resemblances in a research topic.
<b>Interviews/Focus Groups</b>	Gain a deeper understanding of a research topic.

Figure 19 - Types of research methods

Although a bit of each method was used during the research for the thesis, the main methods were used as follows:

a) to collect primary data

- Research through literature study (google scholar).
- Comparison with successful entities that are leaders in the field.
- Interviewing customers.
- Personal experience.

b) to analyse/develop

- Research Online.
- Literature review.
- Personal experience.
- Guidance from the employer.
- Field related software analysis.

#### 4.1 Finding and understanding key concepts

According to Virginia Tech University (2021), the interview research purpose is to acquire a good amount of information from a few people (interviewees).

Key points to focus on in the information collection stage are attributes, preferences, behavior, feelings, opinions, attitudes, and knowledge.

For qualitative research, interview research is an excellent method. Interviewing people helps to understand and explore people's opinions, experiences, and behavior, among other factors. To improve the study reliability, open-ended questions in interviews aid in getting in-depth information and not limit the study subjects to choose an answer affecting the final result.

#### 4.2 Implementation of key concepts strategy

The first step of an interview is creating the interview questions. When crafting interview questions, it is essential to understand who will be answering them and make them sensible for the target. To have good questions, they have to have a purpose. They should ask what the interviewer ultimately wants to know. For example, if the user wants to know the favorite car color from a group of people, a good question would be: "What is your favorite car color." a wrong question would be: "What is your favorite car?". This oversimplified example might strike some people as obvious. However, it often gets overlooked. (Virginia Tech University, 2021)

Once the questions are crafted, the interviewer should consider creating an interview guide. The purpose of a guide is to introduce the interviewer and explain the purpose of the interview. Explaining the questions in advance might also be helpful to avoid getting the interviewees confused or without an answer. When presenting the questions, it is also a good idea to have them logically ordered. One way to get more well-structured questions is by arranging them and organizing them by theme. And finally, avoid leading questions. (Virginia Tech University, 2021)

#### 4.3 Interviewing the clients

The interviewing strategy was to develop an initial version based on the research. Then, interview the existing clients to better understand what direction to take with the design, leaning towards what the clients need.

The key questions were:

- What is essential information? This question had the goal of understanding what features or fields the users use the most to be preserved. Or even better, upgraded to further increase the usability and utility.
- What is excessive information? - This question had the goal of understanding what features or fields the users did not use to be removed if they were irrelevant.
- What information is missing? - This question had the goal of understanding what features or fields the users wished they would have. What critical functionalities the application was missing. And most importantly, how many clients were feeling that things are missing.
- In which order should the information be presented? - This question had the goal of understanding how the users use the application. How they go about using the application and in which order they do so. This question is incredibly important for the design process.

## 5 Development

Tietopiiri has software that is built in a monolith way, meaning that the front-end and back-end are built as one piece. The front-end is the application interface, the part that the users interact with, and everything they see on the screen. The back-end is the logical part that the users cannot see. However, it is happening in the background, technically making the application function.

Upgrading the application following modern standards requires separating the front-end from the back-end, which demands the application be fully rebuilt. Recreating the application with current standards and technologies creates the opportunity to introduce new features and redesign weak areas and antiquate areas of the software.

When the upgrading process started, the clients were informed that they would be able to influence the changes by being interviewed and giving feedback on the current version (V4). However, the back-end functionality was supposed to remain mostly the same, while the front-end (user interface) would be entirely new in the upgraded version (V5).

## 5.1 Strategy and tools

At the beginning of the project, all workers from TietoPiiri had a kick-off meeting to discuss what technologies and frameworks should be used. The company was already settled in using Java programming language for the back-end. For the front-end, we unanimously decided on the ReactJS programming language. Each member was assigned which parts of the application they were responsible for. The author was assigned to the front-end development and user interface design.

Initially, the user interface framework was supposed to be Material UI. It turned out that it was not the best choice for our project because it is designed to be used in mobile development and lacked needed features for computer use. It was leading us to move from Material UI to AntDesign framework. Once the interface framework was changed, the tools became set and have been used ever since.

After the tools were selected and the tasks were assigned, the development team created a strategy for developing. Initially, the team broke down their tasks and decided who should work on which tasks to make the most use of each others' skills. For Oleksandrs' part, the strategy was to test and use the V4 version to understand how it works and what it does. Oleksandr searched for weak areas in the design and took notes to later ask the clients (users) about it. From this point, he started to build the new interface and prepared for the future data from interviews to consider how to proceed in the development stages.

## 5.2 Solutions

The solutions created were heavily based on the theoretical frameworks earlier in this thesis. The initial solutions have also taken the feedback from clients into consideration and were improved upon them. Still, they follow the metrics and conventions of good user experience and good user interface. The clients' feedback was primarily considered for feature creation and not structurally, although some changes have been made by request. The most significant developments, in no particular order, are explained and justified below.

### 5.2.1 Login

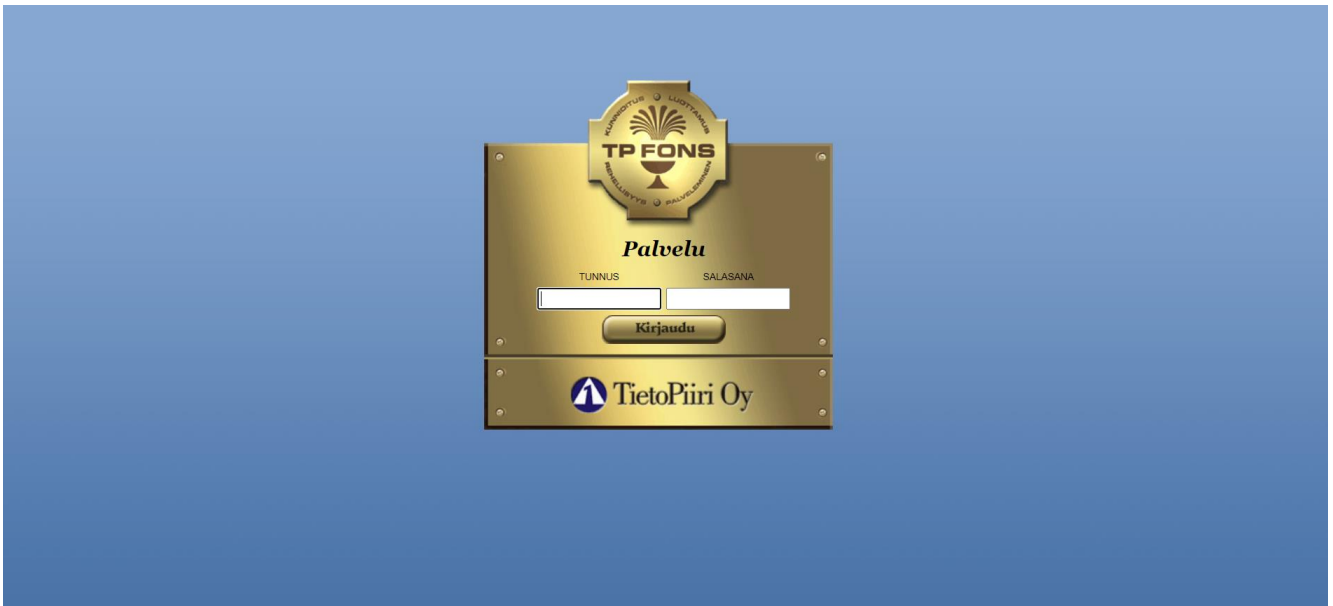


Figure 20 - V4 Login page

A great starting point is the login page. Maybe one of the most basic pages that Oleksandr has done. However, it rapidly set the pace and standard for development. This page had considerations based on the type of users of this application. Things like spacing, color scheme, sizing, and modern interface were considered carefully and applied.

How did Oleksandr become sure that he was on the right path right of the bat? Oleksandr created a few versions of the login page and then added some more pages already prebuilt ready to use from free templates. Then, all of these login pages (about eight different pages, a few with similar color schemes, and some completely different to maintain the users' opinion as unbiased as possible) were sent to the clients, and they were asked to pick their favorite. The clients choose the design that Oleksandr design with the vast majority of votes.

This was a great start, not only for motivational reasons but also, it was a good realization that the clients are reacting as expected and are satisfied. In other words, everyone was on the same wave.



Figure 21 - V5 login page

### 5.2.2 Menu

The menu was one of the most complex solutions to create as there were many problematic zones. Many things were dependant on each other, so the structure had to be completely redesigned. The following picture has the zones selected, numbered, and explained below.

The screenshot displays the TietoPiri Oy web application interface. At the top, there is a main navigation menu (1, orange) with buttons for HOME PAGE, CONTACTS, GROUPS, TASKS, EVENTS, FUNDS, ORDERS, SUBSCRIPTIONS, JÄSENMAKSUT, INPUT, ADMIN, and LOGOUT. Below this is a secondary navigation bar (3, brown) with buttons for NEW ORGANIZATION, NEW PERSON, IDS, FONS EMAILER, TO GROUPS, FROM GROUPS, CLIENT EMAIL, LABELS, TO CSV, and ARCHIVE. On the left side, there is a vertical navigation menu (6) with sections for COMMON SEARCH, PERSONS, ORGANISATIONS, and MEMOS. The main content area (4, blue) shows a search filter for 'Persons Surname' with a search box and a dropdown menu. Below this is a table with columns for name, Organization, Address, and Mobile / Homephone / Workphone / Email. The table contains several rows of test data. At the bottom, there is a 'FREE SEARCH' section (6) with a search box and a 'SEARCH' button. The footer (5) contains a status bar with 'Attach passed', 'Displayed 20 /page', 'Show page: 1', 'Listed 1 - 20 from 548 found', and copyright information for TietoPiri Oy TP FONS JAVA 11 2021/03.

Figure 22 - V4 structure

1 (orange) This is the main navigation menu. Here the users can navigate through the multiple modules of the application. There was nothing wrong with this part, specifically. However, things presented as buttons in zone 3 (brown) are also navigation features that double as actions. As a new user, Oleksandr himself was confused with the interface design.

2 (Green) This is a compilation of functions such as search, filters for the table on the main screen, and navigation to the memos page. Here there were clearly several problems to be addressed. The first problem is the "Common search." It is unclear what is that it searches. Second, it should not be there. That should be in zone 4 (blue) as it searches things in the table. So, logically should be close to the table.

Then the headers "Person" and "Organisations. with the respective sub headers are filters for the table. However, they were not programmed as filters, but as actual different pages, so a user can only have one filter at a time because it just re-renders the whole page (similar to refreshing the page). And they should not be presented there as they are actions related to the table, so they should be grouped with the table.

The "Memos" header is a navigational button just like the menu, so that should be in zone 1 (orange). And finally, all these functions look like a vertical navigation menu, which is very strange for a new user to figure out using it.

3 (brown) These are buttons that correspond to functions that the user can make in the module (navigation tab, Contacts in this case) that he is in. This also has problems such as a



mix of functions and navigation. The "New organization" and "New person" buttons will actually redirect the user to other pages that contain forms with completely different actions. Something like that should be in the navigation menu. The rest of the buttons actually perform functions based on the presented table, so they are sensibly located.

4 (blue) This area has some actions for the table and another search bar. This was confusing for users why there were two search bars.

5 (yellow) This area is quite good to display the functions related to pagination. However, there is an option called "Attach passived" which is a filter, so a good location for it would be zone 4 (blue)

6 (black) This is a general search that can be used to search in the application. Now there is not a problem with the search bar itself besides its location. That was an unusual location for a general search bar. On most websites and apps, the search bar would be at the top of the screen.

These issues were addressed as presented in the picture below.

The screenshot displays the TpFONS v5 application interface. On the left, there is a vertical navigation menu with a dark header labeled "Menu". The menu items include: Home, Contacts (with a dropdown arrow), Persons, Person List (highlighted in blue), Add a New Person, Organizations, Organization List, Add a New Organiz..., Groups, Group list, Add a New Group, Questionnaires, Memos, and Add a New Memo. The main content area features a header with the title "TpFONS v5" and a "General search" bar. Below the header, there are several action buttons: "Add to group(s)", "Questionnaires to V card contacts", "Email", "Labels to CSV", and "Select parent group". The main content area displays a table with the following columns: Name, Address, Email, Website, and Actions. The table contains five rows of data, each with a checkbox in the Name column and a plus sign in the Actions column. The first row is highlighted in blue. At the bottom of the table, there is a pagination control showing "0 out of 100" and "Extra filters". The pagination control includes a "1" button, a "2" button, a "3" button, a "4" button, a "5" button, a "20" button, and a "Go to" field.

Figure 23 - V5 Structure

The main menu was moved to a vertical one on the left side with all the navigatable pages. Now the menu has subheaders to facilitate the grouping of pages.

On the top portion are located the page functions, then filters and table search and sorting feature on the headers of each column in the table. The sorting part did not exist before, this creates value for the user and is extremely easy to use. And at the end of the table the pagination-related things. Lastly, the general search bar was moved to the top right corner, where it is easy to find and where most users expect it.

The interface seems straightforward now. However, it was challenging to organize it sensibly to feel still familiar with the software yet entirely redesign the whole interface. The clients were delighted with the new interface and gave feedback that it still feels familiar to them, and they could use it straight away.

Another new feature with the menu is that it can be collapsed (closed) and still be usable.

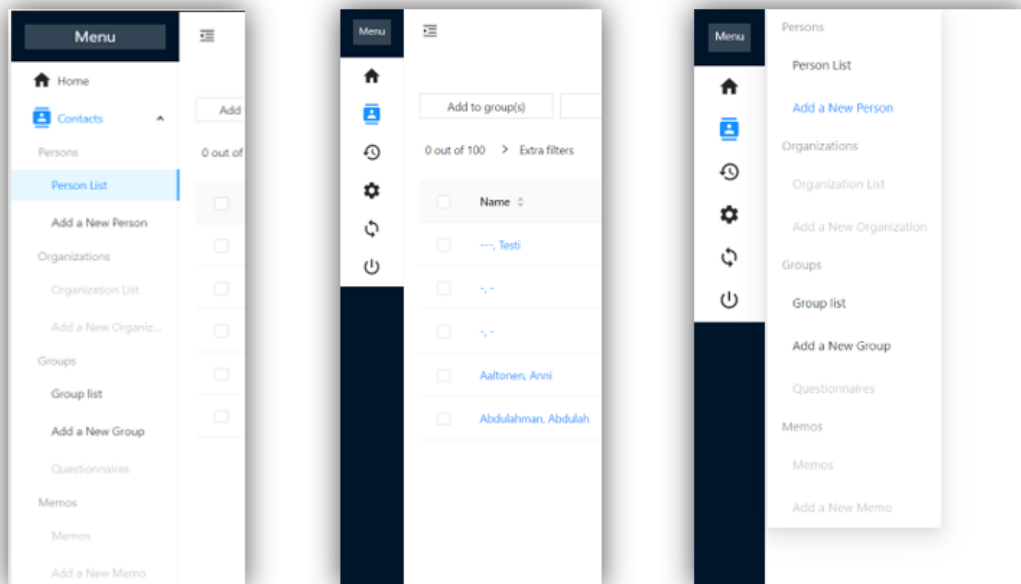


Figure 24 - V4 Menu usability

This feature also delighted the clients as lack of screen space has been a complaint from users. Now besides the new clean interface, they can get that bit of extra space to further enlarge the screen for the things that they need.

### 5.2.3 Modals

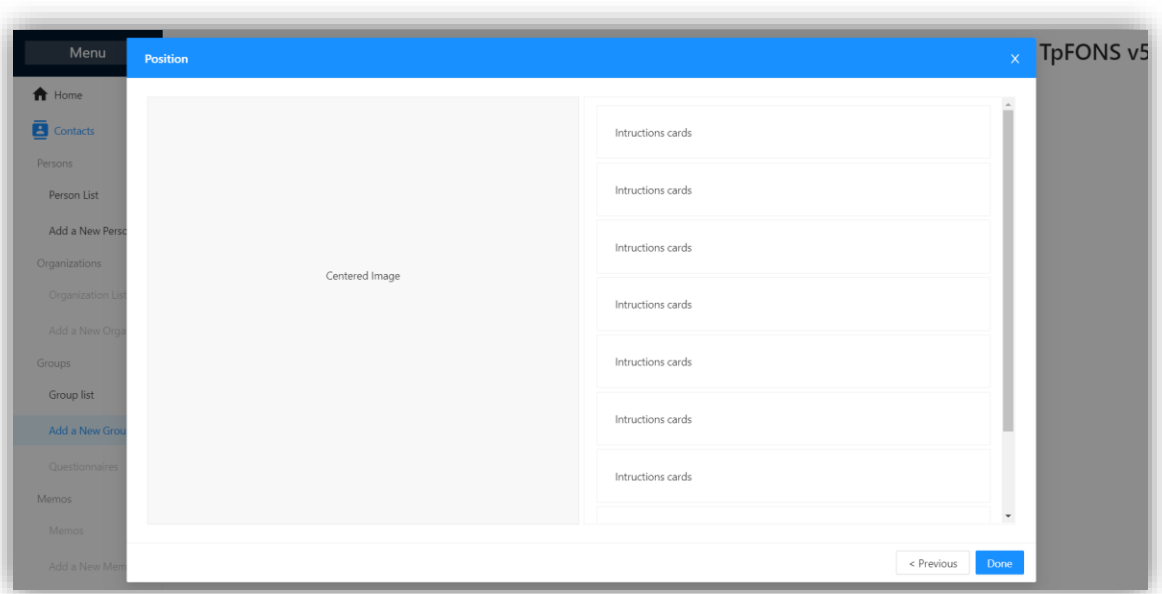


Figure 25 - V5 Modal

The introduction of modals was a huge success. A modal is a content box that appears in front of the page. Some people confused it with a popup window. However, these are different things. A modal is not a new page. Unlike the popup window, a modal is like a hidden view waiting to be activated. The modals were very useful for multiple applications when the user needs to see some information without leaving the current page. For example, in the people table, the users can now edit people's data without leaving the table. They can now click on the person they want to edit, and a modal will appear in front of the table. They can edit, save the changes, the modal will disappear, and the user will still be exactly where he left off.

Modals are a completely new feature in the design. People have been aware of popup windows for a long time, but a modal quickly proved to be more helpful for this application.

### 5.2.4 Tutorial

Having valuable hints and information on how to use the software is an essential consideration in interface design. The V4 version of the application had some tooltips to help users understand the interface better. A tooltip appears when a user hovers over a component. Hovering means positioning their mouse over an object but not click it.

For example, if a user hovers over the "New person" button, it will display a tooltip for that button.



Figure 26 - V4 tooltip

Although tooltips are helpful, interviewing the clients exposed that they struggle with many features, and the tooltips are not enough. Many clients asked for training to use the application. To solve this problem, Oleksandr designed a tutorial to aid users in using the application.

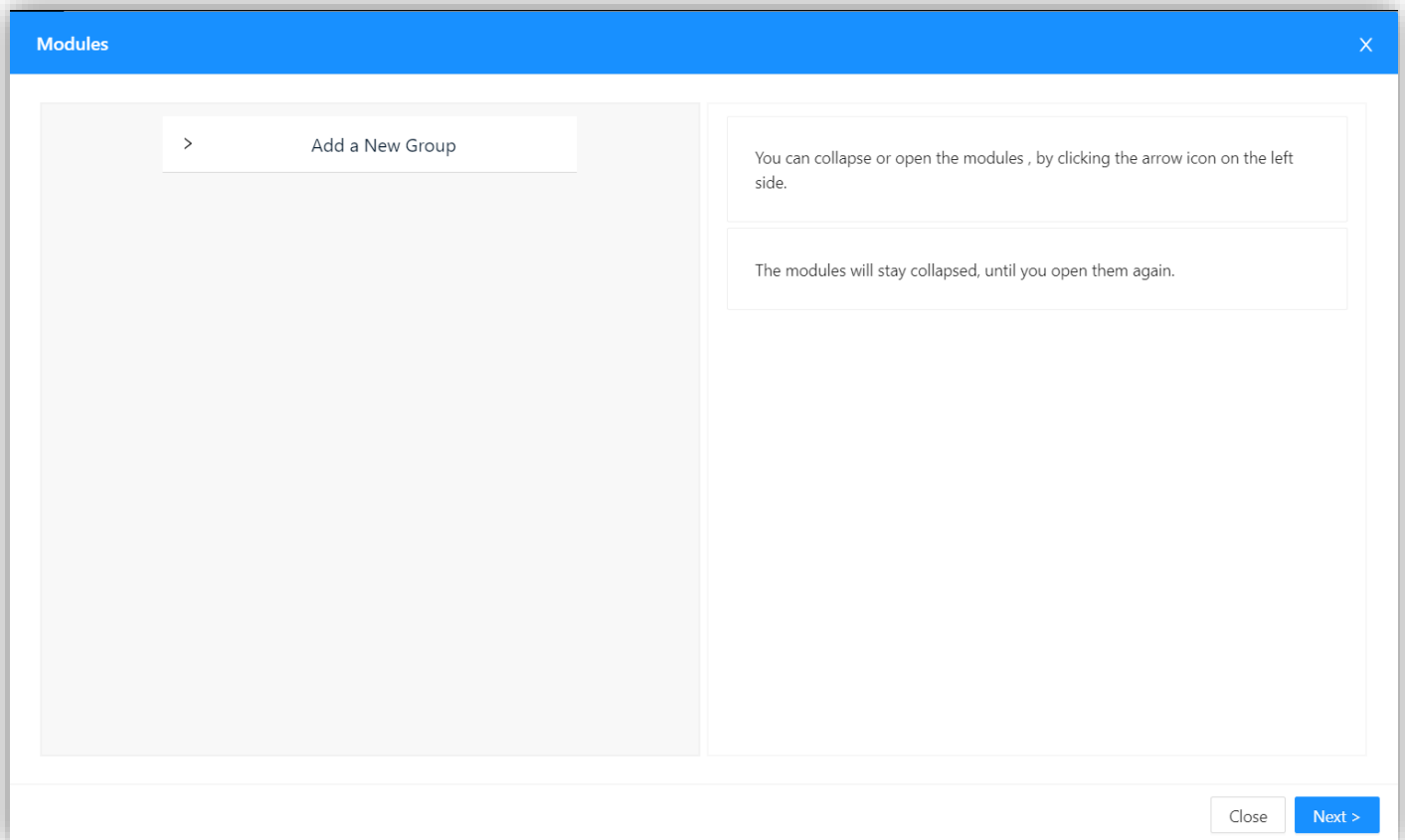


Figure 27 - V5 tutorial modal

With the use of a modal, it was created a view that could be accessed at any point in any page without losing the progress of what the user was doing previously. This is another excellent use case scenario for the modal. Furthermore, clients really appreciated this feature, because it solved a tremendous problem. Now users can have detailed instructions and exact explanations of how each component works at a distance of one mouse click.

## 5.2.5 Formularies

Tietopiiris' software has several pages that contain forms (short for formularies). Most of these forms were very cluttered and confusing for users. Misaligned components, icons, text boxes, and all kinds of components were just a few of the problems with the forms.

**New person**

Surname  First Name

Customer number 985  [Check duplicates](#)

Organization  Spouse

**Contact information**

Mobile

Home Phone

Work Phone

Private Email

Workmail

Other email

Web

Other

Skype

Twitter

Facebook

LinkedIn

**Other Information**

Other Name

Date of Birth (dd.mm.yyyy)

Syntymävuosi

Gender

Language

Task

Title

Year of Registration

Role

- Johtoryhmän jäsen
- Oma eläkeläinen
- Oma työntekijä
- Hallituksen jäsen
- VIP
- Palveluntarjoaja
- Vapaaehtoinen

Mailing ban (do not want to be contacted)

Email Distribution  text message distribution

Address unknown

Dead

Ei kiitoskirjetta

Markkinointiesto

Markkinointilupa

Alaikäinen

Passive

Ei yhdistetä puolisoön osoitetarratuloostuksessa

**Varainhankinnan lisätietoja**

**Home Address**  **The default address**

Street Address

Street Addr 2

Zip

City

Country

**Work Address**  **The default address**

Street Address

Street Addr 2

Zip Code

City

Country

Comments

**Bank account(s)**

Main account

IBAN

BIC

Figure 28 - V4 Formulary

The forms were not designed straight away like this. It becomes evident that some fields were added later. And another issue is that some of the fields are customer-specific. In some cases, the users have to be able to configure which fields they wish to see. Therefore, another design challenge surged. Following the principles learned in the research stage, Oleksandr designed a new formulary view that could be applied to any formulary page.

The screenshot shows the TpFONS v5 V5 Formulary interface. It features a dark blue sidebar with navigation icons (Home, Help, Profile, Settings, Refresh, Logout) and a main content area. The form is organized into several sections, each with a collapse/expand arrow:

- Name and Organization:** Fields for First Name, Last Name, Organization (dropdown), and Kinship (dropdown).
- Contact Information:** Fields for Phone, Home Phone, Work Phone, Personal Email, Work Email, and Other Email.
- Social media:** Collapsed section.
- Bank Account:** Collapsed section.
- Home Address (Default Address):** Fields for Address, Address 2, ZIP, City, and Country (dropdown set to Finland).
- Work Address (Default Address):** Fields for Address, Address 2, ZIP, City, Country (dropdown set to Finland), and a Comments text area.
- Other Information:** Collapsed section.
- Category:** A list of roles with checkboxes: Coordinator, Chairman, Treasurer, Ward Secretary, Operations Manager, Vice Chairman, Board Member, Own Pensioner, Self Employed, VIP, Service Provider, and Volunteer.
- Mailing ban:** A list of communication preferences with checkboxes: Mailing ban (does not wish to be contacted), Email Distribution, Text message Distribution, Minor, Deceased, No Thank You letter, Marketing Ban, Passive, and Not associated with spouse in address label printing.

At the bottom of the form, there are two buttons: 'Submit' (blue) and 'Reset' (grey).

Figure 29 - V5 Formulary

The goals when designing the formulary was to declutter the screen, group the fields and organize them in a sensible order. The view turned out very good, according to the users' feedback. Another feature implemented in the formularies was what is called a collapsible box. The collapsible box allows users to configure which fields they wish to see.

The goals when designing the formulary were to declutter the screen, group the fields, and organize them in a sensible order. The view turned out very good, according to the users' feedback. Another feature implemented in the formularies was what is called a collapsible box. The collapsible box allows the users to configure which fields they want to see. Clients can configure the fields by collapsing (closing) or opening the boxes with the fields they wish to see and use. In the previous picture, it is possible to see that the "Name and Organization" box is open and has four fields in it. Meanwhile, the "Social media" or "Bank Account" boxes are collapsed (closed), so they are not taking space if the users do not need them.

### 5.2.6 Tables

Tables are often used in the application. The tables also needed some improvement and more features to ease the users' life. It is possible to see in the following pictures the mobile view was unusable. And the table did not provide much functionality.

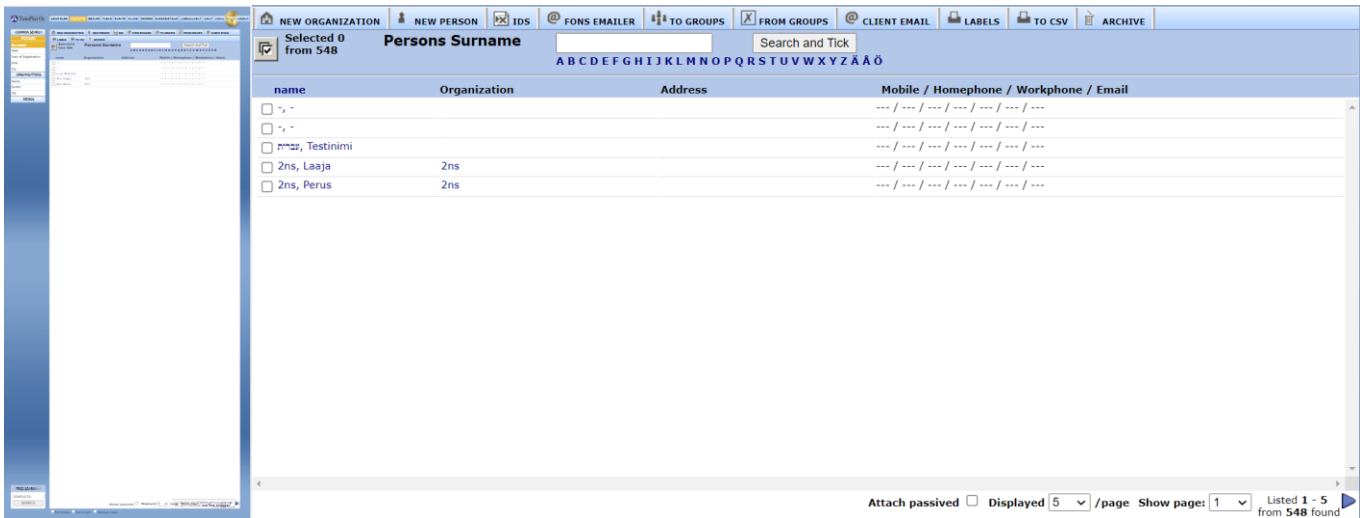


Figure 30 - V4 mobile view and table

To improve the table, besides the new graphic design, a lot of new features were implemented into the table.

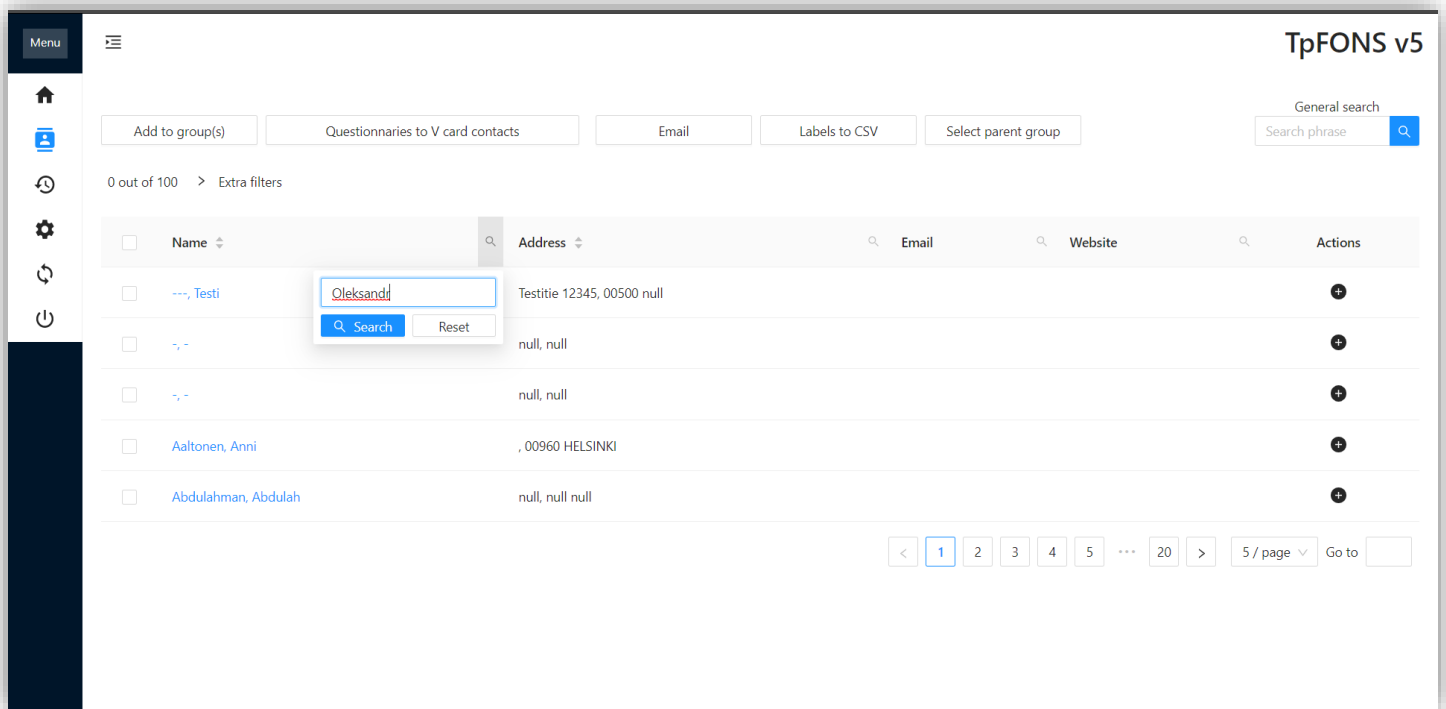


Figure 31- V5 table

Sorting - Clients can sort the list by ascending or descending order in any column.

Individual search bars - Clients can do a quick search by each column. And they can even configure which columns they want to see.

0 out of 100

Extra filters

**Name filters**

First name

**Address filters**

Address

Country

**Contact data filters**

Email

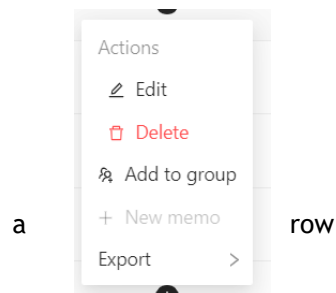
**Miscellaneous filters**

Job Descriptor

Apply filters   Clear filters

Filters - The clients can now filter records by any data (for example, by birthday, city, nationality, language, pretty much any field filled in the formulary when creating a new record).

Figure 32 - V5 table filters



Row actions - Clients can perform tasks directly to In the table.

Figure 33 - V5 table row actions

These features dramatically improved the user experience and usability of the tables. The clients were thrilled with these changes. Also, the mobile interface was significantly enhanced. In the next point, there will be more information about mobile use.



## 5.2.7 Mobile compatibility

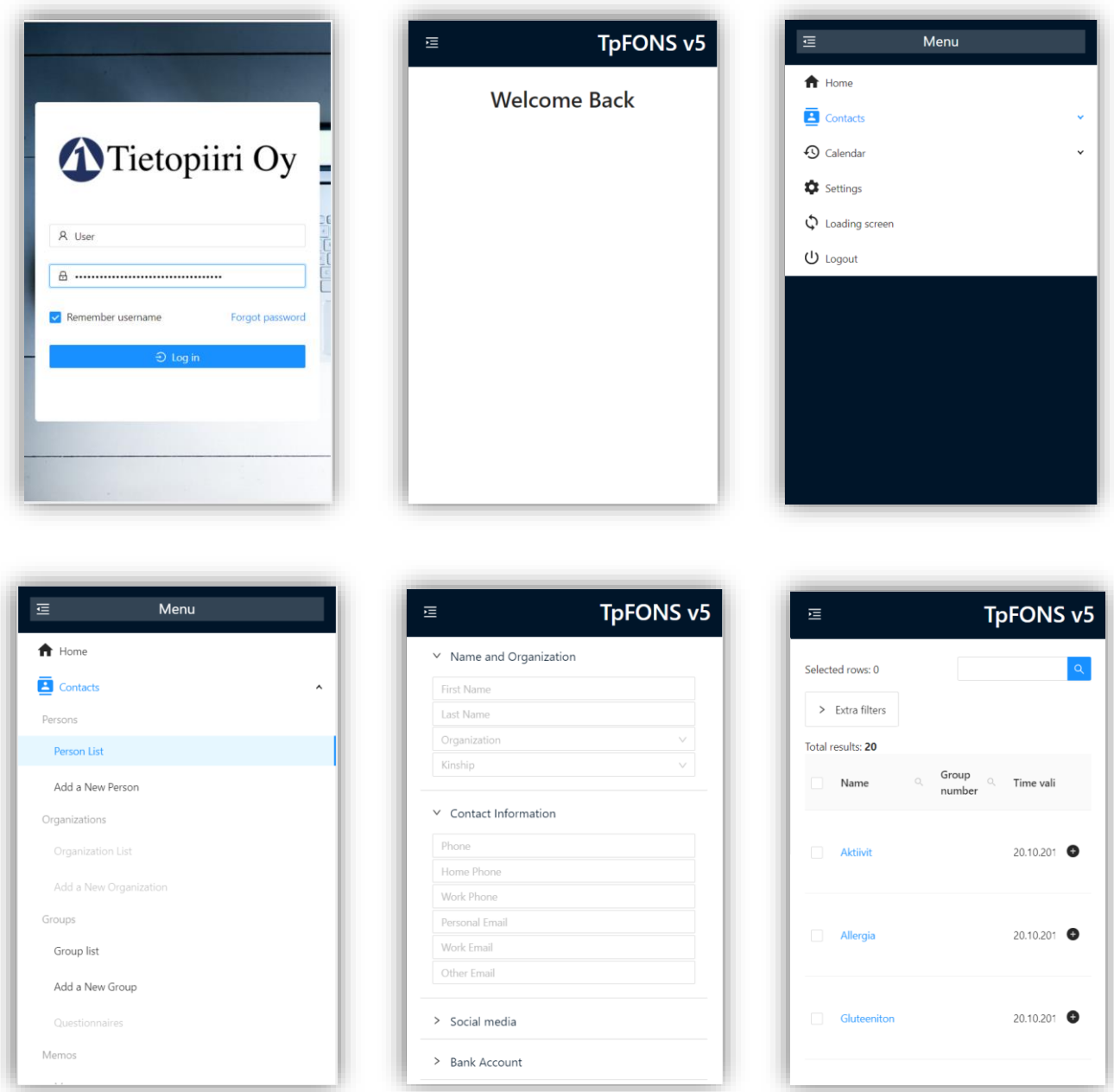


Figure 34 - V5 mobile views part 1

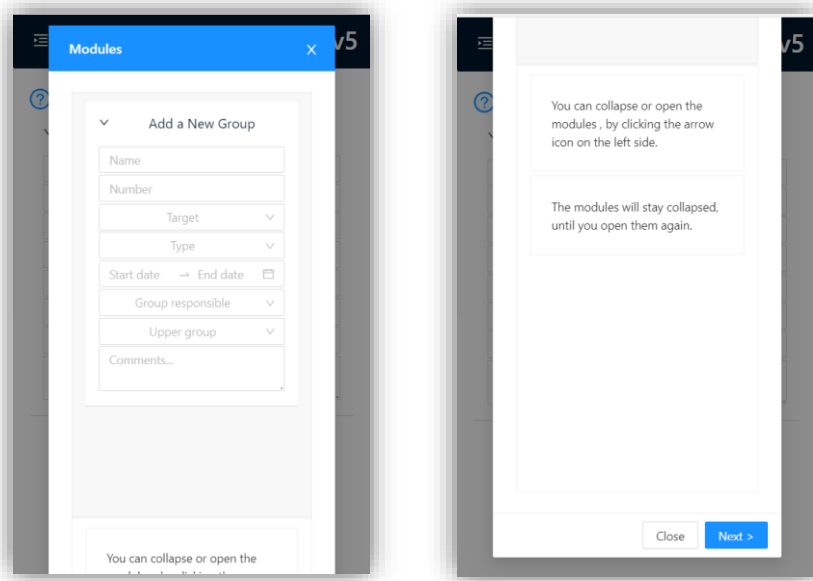


Figure 35- V5 mobile views part 2

The pictures above give an overview of what the application looks and feels like currently. Before, the application was unusable in mobile view. When the interface was designed, smartphones did not exist yet, and the interface reflected that. Therefore, the users are not used to use the application on mobile view. However, with the new interface, that might change.

In the design process, a responsive grid system was created. A grid system allows components to dynamically readjust their size according to the screen where they are presented. The grid was built and configured to accommodate phone screens, tablets, and computer screens. It does not only allow for a responsive experience in various screen types, but it also allows the components to be aligned and sized properly by being fixed in the desired places. This way, when the screen size changes, the components will move to where the grid guides them.

#### 5.2.8 Language Pack

As the working language in the company was in English, the development was also done in English. But the application is in Finnish. So to address this issue, a language pack standard was created in the early development stage. By having a standard to create the languages, it becomes easy to add more languages to the application. All that will be needed is the actual translation, and the code does the rest.

Currently, the application is fully in English. However, it is partly translated in Finnish, and there is space for many other languages if necessary. This is also beneficial for non-Finnish-speaking users or clients, which expands the variety of users that can use the application.

## 6 Outcomes

There was a tremendous amount of evolution during this study. The student gained a deep understanding of designing principles for interfaces and about UI and UX. He created great interfaces that impressed the clients and the company.

### Achievements

The author achieved his goals of starting to develop the V5 version, connecting with the clients, and understanding their needs for the application. He created standards and guidelines for future developments. And he learned a lot about software development, new technologies, and work organization.

### Unexpected outcomes

As in every project, there were unexpected setbacks. One example was when it was needed to change the user interface framework and redo a lot of coding. Other setbacks happened. For instance, sometimes, the users did not like a particular design, and the interface had to be reinvented. However, the student only grew from these mistakes and setbacks. The student believes that it is by failing that people genuinely learn to succeed.

### Future considerations

Oleksandr intends to grow further his knowledge in interface design and leverage human psychology into creating unique designs for the future. Regarding the future consideration of the V5 design, there is still a lot of areas to improve. However, a challenge is always welcome. For the V5 a lot of points from this thesis can still be applied in the future.

## 7 Conclusions

It has been a very exciting journey. There were a lot of setbacks and a lot of successes. There was a lot of learning, and there was some teaching. The author grew as a person, as a student, and as a professional. Many technologies, practices, and conventions were learned. The student improved his organizational and communication skills. Now the author can confidently work in a company knowing that he can provide value.

The author recognizes that, constantly, there is more to be learned as he gains experience and his thinking evolves, and the industry continuously moves forward with new technologies and possibilities.

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