University of Rijeka, Department of Informatics

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Designing, prototyping and testing a company travel management application

Graduate thesis

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Master Thesis Task

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Task description:

UX is a process that includes behaviours, attitudes, and emotions that users experience when they use a particular product, system, or service. The task of the graduate thesis is to study the methodology of designing, prototyping and testing the web application, and to describe the whole developing process with the emphasis on UX design. As a practical part it is required to design, prototype and test web application for company's travel management in the selected set of tools.

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Abstract

By using various techniques of Design thinking methodology, this thesis describes the entire "life cycle" of creating a web application for managing a company's business travels. The process of designing, prototyping and testing the mentioned application is explained in more detail through the phases of understanding a problem, designing the solution, prototyping and testing it on real users. The experimental part of the thesis includes designing, prototyping, and testing a company's management of business travels using different tools and script languages such as Adobe XD, Creatly, HTML, CSS, JavaScript and Angular.

Key words: Design Thinking, Design System, Design Sprint, Adobe XD, Angular, Design, Prototype, Test, User experience.

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1. Introduction

The main reason for website and web application success is very simple: it is based on the basic principles of design. A noticeable, efficient site is inventive, easy to remember and have a sense of uniqueness at some level. Such sites and applications remain in the mind of the observer in relation to competing applications and there is a much greater chance that this will result in back-up traffic. However, good design does not start and finish with the visual aspects of the product. In order to truly succeed and have satisfied users, the application or website must be accessible and user-friendly. In other words, the user experience or shorter, UX must be emphasized.

« User experience design is the process of enhancing user satisfaction with a product by improving the usability, accessibility, and desirability provided in the interaction with a product. It refers to a person's emotions and attitudes about using a particular product, system or service. » [1] It also includes the practical, experiential, effective, meaningful and valuable aspects of human-computer interaction and product ownership. Additionally, it includes a person's perceptions of a system with aspects such as utility, ease of use and efficiency. It can also be considered subjective in nature to the degree that it is about individual perception. User experience is very dynamic because it is constantly modified over time due to changing usage circumstances and changes to individual systems. It is also about how the user interacts with and experiences the product. User experience (UX) is the practice of designing products, processes, services or events and environments, with a focus placed on the quality of the user experience. Experience design is not driven by one design discipline, instead, it requires a cross-discipline perspective or interdisciplinary approach.

Because of the just-mentioned importance of the UX design, this thesis, describes the UX side of designing, prototyping, and testing a product, in a case web application for managing company's business travels, using various tools such as Adobe XD, Visual Studio Code, and scripting languages such as, Hyper Text Markup Language (HTML), Cascading Style Sheets (CSS), JavaScript, and also framework Angular for easier development of a prototype. It is also explained how and which techniques you can use to generate new ideas and solutions. Additionally, the thesis introduces the methodology called Design Thinking and Design Sprint that are often used when creating a new product. Particular importance is also given to the

design systems that are becoming increasingly popular every day and take on a great deal of importance in the process of developing and also documenting a new product. At the end of the thesis it is presented how to do usability testing on real end users, and why testing is the key element in accomplishing a good user experience.

2. Design Thinking

In a world led by smartphones and social media, we expect from businesses and governments to deliver personalized experiences to users on any device in real time. And while users still go to the store to buy groceries or get on a plane to travel from one point to another, the way they consume goods and services is fundamentally changing. This also means that the way companies are designing and building these experiences must evolve to keep pace. This approach will help design thinking and agile development (Agile software development is an approach that includes a set of practices and frameworks that are used to create a new product and deliver it in small increments instead of one big launch. It is an iterative approach.) but the principles they are based on can be a great asset to anyone trying to solve a problem or find better ways of getting work done.

Design Thinking is a method for creating practical and creative solutions that evolved from varied fields such as engineering, architecture and a lot of different businesses. At its core design thinking is focused on understanding people's needs and discovering the best solution, in a creative way, to meet those needs. Its main concepts are understanding, exploring, prototyping and evaluating. This type of thinking has attracted managers from around the world to use it for different types of business-related innovations. Apart from the commercial sector, this type of approach can also be used in administration, health care, financial services or civil society organizations. [2]

The main ideas of how these type of thinking works, will be explained in the next few sections.

2.1. What is the process of Design Thinking

As already mentioned, the Design Thinking process is on - going and highly user-oriented. Before looking at the whole process in more detail, it is important to reflect on the four main principles of Design Thinking presented on Figure *1*:

Figure 1. 4 principles of Design thinking (Source: https://careerfoundry.com/en/blog/ux-design/what-is-design-thinking-everything-you-need-to-know-to-get-started/)

Every design activity and any social innovation brings UX designers back to the user-centric point of view. If we want to see things differently, we need to experiment with the limits of our knowledge and abilities. Essentially, we only redesign the things we need to fulfill and reach our desired outcomes.

To begin with, UX designers need to understand customers and feel the reality in the way they feel, understand their motivation and frustration, or, popularly said, "to put himself in their skin". Considering a series of unusual and innovative ideas that will meet customer's needs, are giving designers the freedom to suggest anything. Brainstorm is one of the possible techniques that is very simple, efficient and allows designers to get a lot of ideas in the shortest possible time. After designing ideas, designers return to their users and test whether their solution really solves the problem, improving the quality of life, work, or environment. In the end, designers are turning the idea into something specific, into the final product. The success of this method lies precisely in its ability to transform the aspect of the life of the end user, thus creating visible effects. Without the realization of ideas, there is no future. [3]

A company can benefit from using these approaches when expanding their business, as can be seen from the following example. There is a small and successful Croatian craft shop that is designing and manufacturing handmade jewelry. They have had sudden growth over the few past years, so they decided to launch their online shopping website. Even though their in-store sales continue to grow, their website sales haven't met their expectations.

The owner of the shop decides to involve UX designers to help him figure out what is the problem of that small sales rate. Designers decided to use the design thinking methodology to help the owner with increasing business profit. First, they need to find out who his real users are, what they think, how they feel, what they see, hearsay and do. Not satisfied with the current state, the business design and also the engineering team started to collaborate and mutually decided to find people that have a shared interest in jewelry and are familiar with the products.

After the initial search, the team narrows its focus to a candidate that meets a wide variety of helpful criteria and agrees to provide the team priceless insights as the business grows. As the team begins to work with the candidate they gain the insights they otherwise would have missed. This research is crucial in making improvements for its users. For example, they find out that the costumer, despite being interested in jewelry doesn't know where to begin. Although the customer likes the way jewelry looks online, there is not enough description about the material that is used when creating them, and also it is not clear how the customer can know what is, their size, and that is a problem with which customers do not meet when they are buying in store.

With this new information, the team regroups with the larger team to plan the next steps for refining the challenge or Hill statement.

They started to define how they will build a solution to a problem with new features. The process begins with creating sketches that will later be transformed into more formal designs, a high-fidelity one so they can better represent the value their users need.

The team then starts to develop a prototype that contains all the newly created ideas. They take the prototype back to the end user to test its effectiveness and get feedback from. The team will iteratively refine the product at each step of the way to make it suited to the user and more seamlessly integrated with the existing website.

Finally, the team delivers the new shopping experience which is closely monitored to ensure it could be continuously upgraded based on insights they collect from the usage metrics and new customer needs.

By using the design thinking principles, the jewelry business is able to define and solve their client's needs by putting the end user first. By applying design thinking methods, UX

designers are able to deliver new functionality using an iterative approach that was transparent and minimized risk. [4]

By taking a closer look at the given example, it is noticeable that the whole process could be split into five steps or phases, also known as Empathize, Define, Ideate, Prototype, and Test (Figure *2*). In the next sections, those phases will be discussed more deeply.

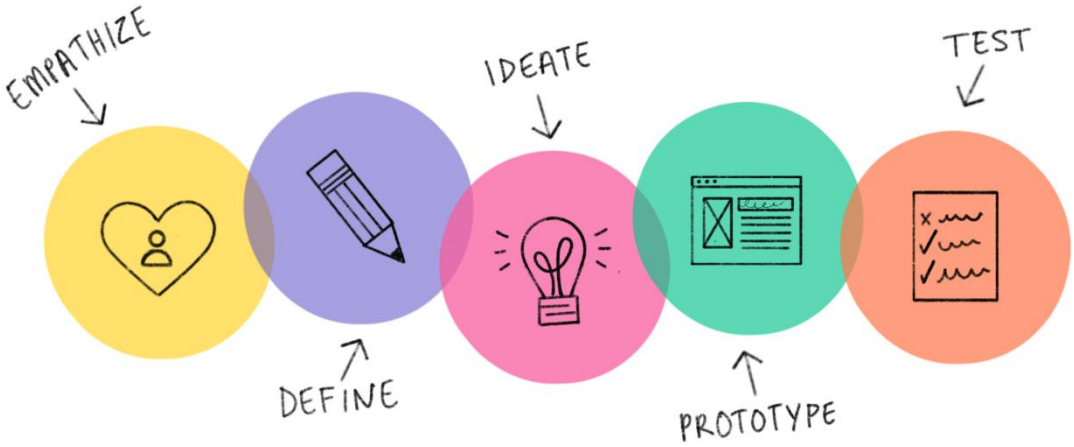

Figure 2. Phases of Design Thinking (Source: https://dribbble.com/stories/2019/03/22/what-is-design-thinking)

2.1.1. Empathize

Empathize revolves around the need to really understand the problem from the perspective of the end user. Ultimately, the purpose of the first step is to understand the situation as a whole so that UX designers can better comprehend what is needed. Designers should show interest to their users and show them how they care about their lives, problems, and concerns (Figure *3*).

« Empathy is the centerpiece of a human-centered design process which is a design and management framework that develops solutions to problems by involving the human perspective in all steps of the problem-solving process. » [5]

2.1.1.1. Why empathize

For the design thinkers, problems they are solving, usually they are not their own, instead, they are problems of a particular group of people. In order to design for them, it is very important to gain empathy for them, by putting themselves into user's skin. By observing and watching people design thinker can see how they think and feel about some particular subject and it allows him to capture physical manifestation of their experience.

Some of the best solutions usually come from the insights of human behavior. The main problem is to recognize them, because human minds, usually automatically filter away a lot of possibly useful information, without being aware of it. Because of that, it is very important to look at things popularly said: "with a fresh set of eyes", and this is something that one can get by empathizing.

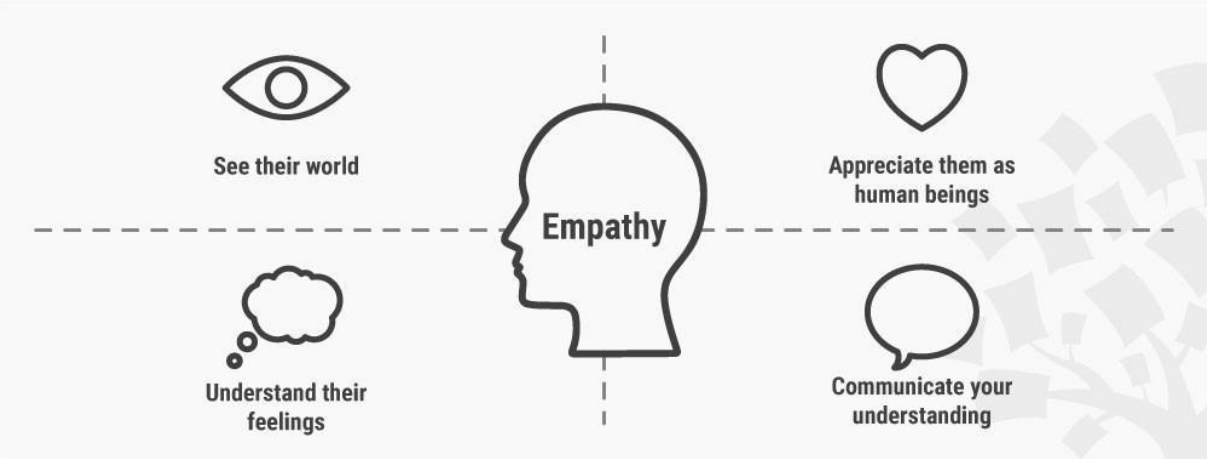

Figure 3. Empathy (Source: https://www.interaction-design.org/literature/article/stage-1-in-the-design-thinking-process-empathise-with-your-users)

2.1.1.2. How to empathize

To empathize, it is required to:

- Observe

It is necessary to look at the users and their behavior in the context of their lives i.e. from their perspective. It is also important to observe their behavior in relevant surroundings and to conduct a lot of interviews. Some of the most meaningful conclusions are the one that was captured from noticing the meaning and difference of what the user is doing and what he is saying.

- Engage

This part is usually called interviewing, but it feels like a normal conversation. The designer needs to prepare a couple of questions, and always ask users “Why?” so that he can uncover deeper meaning.

- Watch and listen

A designer should ask the user to show him how they would complete a particular task, and by doing that designer is combining observations and engagement. It is important that when completing a task they are talking designers through the whole process by expressing everything that is on their mind.

After finishing with the empathy phase, it is important to process all documented things collected until this point. This way Designer can better understand the problem users are dealing with. Also, it is helpful to use different methods and techniques that can help at this stage. For example, pictures of the users could be posted on the wall together with some post-its notes with meaningful quotes. Designers could also create a user journey maps, diagrams, and anything that can help them capture information about users and the problem. [6]

2.1.2. Define

In the define step of the process, the information collected from the empathize phase is analyzed and interpreted. This step allows designers to reflect on the problem they established in order to create a plan on how to address the need for a solution. This phase is focused on transforming that need into a well-defined plan.

2.1.2.1. Why define

Phase Define is the key one in the design process since here designers are defining the problems that they are trying to solve. Also, here they try to synthesize ours, maybe scattered findings into powerful insights. The very synthesis of their empathic work is something that gives them the enormous advantage other methodologies do not have.

2.1.2.2. How to define

It is crucial for designers to remember the things that stood out to them when they were talking to the users, and from that, they should try to emerge some patterns. They should work to express the insights they developed through the synthesis process of the information they have gathered through empathy and research work. Then it is important to define a point of view that includes users, their needs and insights. A point-of-view should frame the problem, but also inspire the team and allows them to make decisions unassisted in parallel.

A good way for a transiting into the next phase is by creating a list of "How-Might-We…?" brainstorming topics that appear from the definition of the problem. These brainstorming topics focus on different aspects of a problem, and usually, they represent a subset of the entire problem. [6]

2.1.3. Ideate

The ideate step in the process utilizes a creative mindset to determine an innovative solution. In this step, the solution is being imagined and research is being conducted on how to create reality from that image. In other words, this is the creative phase that allows the mind to ponder the details of the solution. In the ideate phase, designers are concentrating on generating ideas.

2.1.3.1. Why ideate

Through the ideate phase, designers are transiting from identifying problems to creating the solutions for the users. In the early stages of the designing, ideation is all about providing the ideas of the widest possible range, from which they can, later on, select the best solutions. The best solution will be discovered later, in the testing phase, through the feedback they get from your users.

2.1.3.2. How to ideate

By adding constraints and finding inspiring related materials UX designers can start with the ideate phase. Prototyping can also be a type of ideation. Also, there is brainstorming, sketching and mind mapping techniques that can be used to help designers find the solution and generate a lot of ideas.

It is suggested to gather all the generated ideas and then vote for two or three best options and bring them into the next phase, the prototype phase. There are multiple ways of deciding which ideas will be prototyped later on, but the suggestion is to pick “the rational choice”, “the most likely to delight” and “the most unexpected one”. [6]

2.1.4. Prototype

During the next step - prototype, a physical or tangible solution is created. This step allows the designers to create something new and tangible that they formed in the ideate phase. During the prototype phase, the solution is brought to life while keeping the end user in mind.

A prototype is anything that a user can interact with, so it could be a wall of post-it notes, a gadget you created, a role-playing activity, or even a storyboard. In this phase designers are trying to create something that will bring the user experience.

2.1.4.1. Why prototype

Prototype represents a cheap and rapid way of finding out if the designers managed to solve a problem. It also allows them to test different possibilities of a solution.

2.1.4.2. How to prototype

A prototype should deliver answers on a particular subject later in the testing phase, but when building one it is important to always have in mind what is the main goal of building that prototype and what kind of user behavior is expected from it. [6]

2.1.5. Test

In the test phase prototype is reviewed, feedback is gathered, and adjustments may be made. This step involves finalizing the solution that will actually be provided to the end user. The test phase is reserved for detailed, fine-tuning and testing, ensuring that the prototype will meet the needs of the end user. While the test phase provides a solution to the initial problem, this process may need to be repeated until that solution is perfect or exact. As a result, designers can turn to the first step of the process and repeat each phase that can be necessary for getting a successful result.

2.1.5.1. Why test

The testing phase is used for improving and refining the prototypes and solutions with information collected from the users. Sometimes it can happen that it is necessary to go back to the drawing board. Testing gives designers another opportunity to build empathy throughout their observations.

2.1.5.2. How to test

By giving the prototype to the users and watching them using it designers are capturing users' behavior and the whole experience that comes with it. Designers should not explain to the users how to use the prototype or give don't give them any directions. By gathering users' reactions and experiences throughout the testing, according to the results, designers decide if they need to repeat or iterate some of the phases of the design thinking process or if they have successfully solved the problem.

This process should be viewed as cyclical in nature, allowing the design to be centered on the true needs of the end-user. Design Thinking is a process that does not follow a predetermined form but is characterized by constant changes. To sum up, this means that after testing designers do not have to go back to the empathic phase, they can return on the ideate phase, or on the prototyping phase, depending on what they have learned with the test. That is why this process is considered non-linear. Iteratively is also an essential determinant of the design process because it involves less, faster prototype modifications to get back to the market as quickly as possible and re-gather as much thought and criticism as learning and improving. The process needs to be implemented as long as the needs of the end user are not fully met. [7]

The next chapter describes the process of building an application for managing a company's business travels with the implementation of some techniques and core idea that stands behind the design thinking methodology.

3. Building a company travel management application

In this chapter, the process of building a company's travel management application is described through the phases of understanding the problem, designing the solution, prototyping it and testing it. The company for which the application is being made is called Esteco. It is a company located in Trieste, Italy, with the main focus of creating and developing software that is highly specialized in numerical optimization and simulation data management.

In the beginning, the thesis defines the main problem. After the problem is defined, the main goal is to find solutions and start designing them. Merged solutions eventually will become a prototype of the product that needs to be represented to the end users for testing. After the testing, we collect obtained feedback and, depending on the results, we accept or improve the product. Also, special attention is given to the design systems and their importance when creating a new product.

3.1. Understand the problem

When creating any new product, including applications, the best way to start is with recognizing the problem. To solve a problem, it is important to understand it. Since we are dealing with creating a company's travel management application, to understand the underlying problem, it is necessary to collect all available information about the problem, i.e. the reason for needed change in business or for creating a new product.

At the start, it is necessary to study the existing products and the way the company has been dealing with the company's travels. We can access this information through different approaches and techniques. One of the most effective methods is to interview the users of current, but also, future product, to find out their frustrations, problems, and reasons for their desire to change managing the travels. Apart from implementing the interviews, various surveys and questionnaires can also be handled that can also deliver wanted results. Questionnaires are a great choice for testing a large group of people, but in the case of only a few potential respondents, it is more effective to conduct an interview in person. In that case, apart from receiving the answers from respondents, a designer can also monitor their behavior when asking questions.

For this problem, the method of interviewing was used. At the very beginning of the whole process it was necessary to make several conversations with the users, and during the conversation and interviews, document the user's behavior, and dissatisfaction. This should be done without intercepting users during the interview as one of the key things one should pay attention when interviewing or conducting product testing.

Some examples of business trips that users want or have to go are a conference, training courses, visit clients around the world, visiting an office other than the one they are located in (for example, the office in India or the United States). If a user goes on a business trip, he is required to download a pdf form (Figure *4*, Figure *5*) that must then be filled in with the correct information and in the correct way, and then it needs to be sent to the administration office so that they can print it and sign it. After the administration approval, the user's manager also needs to approve the form. Apart from the fact that this whole process is very complicated and old-fashioned, the problem is that the form is very vague and users often do not understand with what type of information the form needs to be filled in.

For these reasons, there is a need for change and introduction of simpler and more modern solutions that would ease the whole process, both for the users and for the administration.

RICHIESTA DI TRASFERTA **AT-**

1

Io sottoscritto/a _____

Chiedo l'autorizzazione ad effettuare una trasferta:

Luogo: _____

Motivo: _____

Dal ____/____/_____ al ____/____/_____

☐ Legata alla conferenza/corso: _____

- ○ già prenotata in AT- _____
- ○ chiedo all'Amministrazione di prenotare entro il ____/____/_____
- ○ me ne occupo personalmente – *La ricevuta quindi deve essere a TUO NOME*

☐ **Richiesta di anticipo** tramite bonifico, che va richiesto con un anticipo di almeno due settimane:

Totale anticipo: _____ € da effettuare entro il ____/____/_____

Io viaggio:

○ da solo

○ con altre persone Esteco (Cognomi) _____

Extra Esteco (Cognomi) _____

☐ Prendo ferie dal ____/____/_____ al ____/____/_____

1. Tutte le spese vanno effettuate esclusivamente con **carta di credito e/o bancomat**
2. **Italia**: richiedere sempre la **fattura** elettronica intestata a Esteco per vitto e alloggio (**serve il QR Code**)
3. **Estero:** richiedere la **ricevuta** (nel caso dell'albergo, la ricevuta deve essere intestata a proprio nome)
4. **OGNUNO DEVE PAGARE PER SE'**

Figure 4. Travel document (1/2)

☐ **Aereo**

- ☐ **Andata**: da aeroporto _____ ad aeroporto _____
  - Preferenza volo (codice): _____ orario _____
  - Preferenza volo (codice): _____ orario _____
- ☐ **Ritorno**: da aeroporto _____ ad aeroporto _____
  - Preferenza volo (codice): _____ orario _____
  - Preferenza volo (codice): _____ orario _____
- **Bagagli straordinari** (*se non compili i campi seguenti, dovrai occupartene personalmente al check-in, ricordandoti sempre di chiedere la ricevuta*)
  - ☐ Bagaglio da stiva: numero _____ peso (kg) _____
  - ☐ Altro: numero ____ dimensioni (cm) _____ peso (kg) _____
  - ☐ Altro: numero ____ dimensioni (cm) _____ peso (kg) _____

☐ **Navetta**

- ☐ **Science Bus privato** (solo per partenze/arrivi notturni da Venezia tra le 23 e le 8)
- ☐ **Andata**: pick up (indirizzo): _____
  - ad aeroporto: _____
- ☐ **Ritorno**: da aeroporto: _____
  - drop off (indirizzo): _____

☐ **Treno**

- ☐ **Andata**: dalla stazione di _____ alla stazione di _____
  - Codice/i treno/i suggerito/i _____ orario _____
- ☐ **Ritorno**: dalla stazione di _____ alla stazione di _____
  - Codice/i treno/i suggerito/i _____ orario _____

MEZZI STRAORDINARI DI VIAGGIO

☐ **Noleggio auto** – *In questo caso vanno specificate le* **MOTIVAZIONI** *dettagliate che rendono necessario il noleggio:*

_____

Figure 5. Travel document (2/2)

After collecting the information, we have got an image of the current state of the situation, and the best way to document the current state of user flow is to create a user workflow diagram. There are more ways to record and document the current situation, but we have decided on this variant. Also, when creating a diagram there are various free tools that can help easily create a state diagram.

To create a diagram of the current user interface workflow, a free online tool called Creately is chosen.

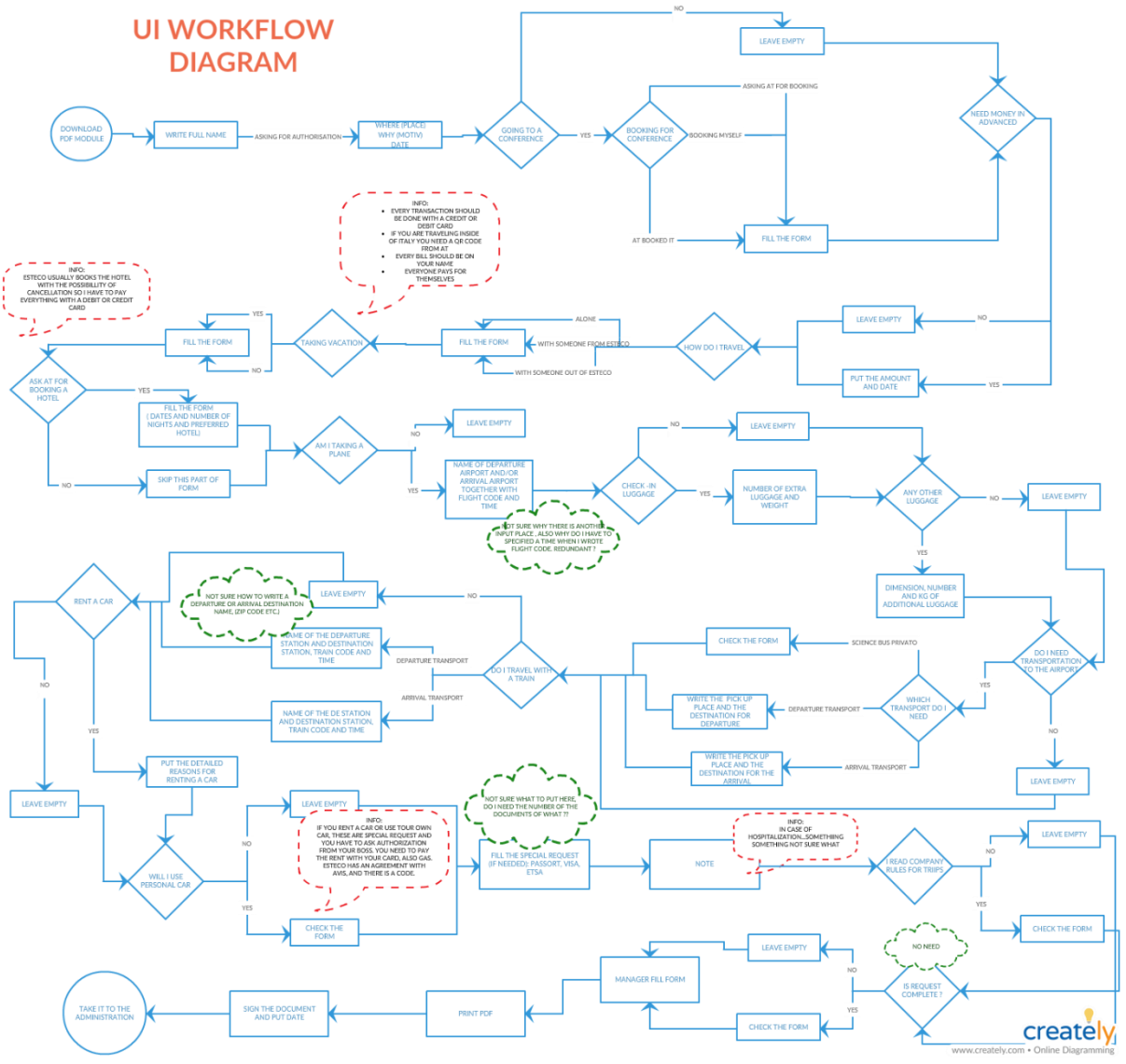

Figure 6. UI Workflow diagram - representing the current state of a problem

In Figure *6*, the status of the current user workflow is displayed, where the rectangles indicate the state, the rhomb indicates the transition condition to a new state, while the arrows indicate the way of the user flow journey. Also, the diagram consists of a various number of "clouds" that represent some additional information provided to the user during the process of filling the request document. As we can see from the diagram, the current state of the UI workflow is rather complicated and needs to be simplified and clear for the user. In Figure *7*, you can see the presentation of the same state but instead of using Creatly, Adobe XD was used. It is a software that is mainly used for user experience design. It allows its users to create professional mockups, wireframes or prototypes. Adobe XD allows a better representation of the situation, gives much more canvas for the user, and also contains all the elements needed in this process that are pre-made and can be downloaded from the Adobe official website. (Figure *8*)

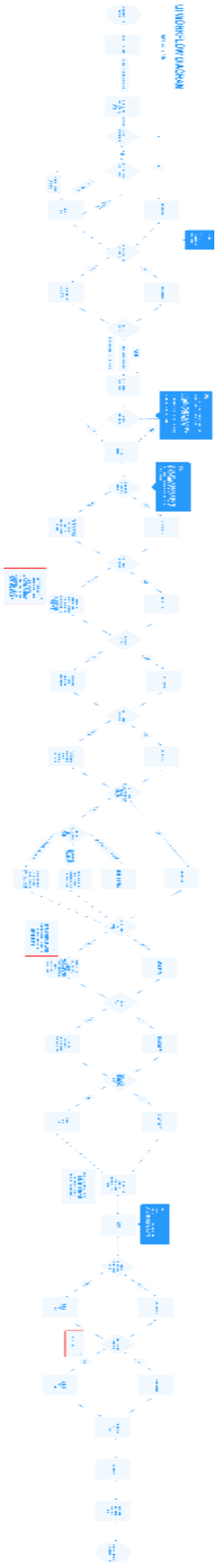

Figure 7. UI workflow diagram of current state (Adobe XD)

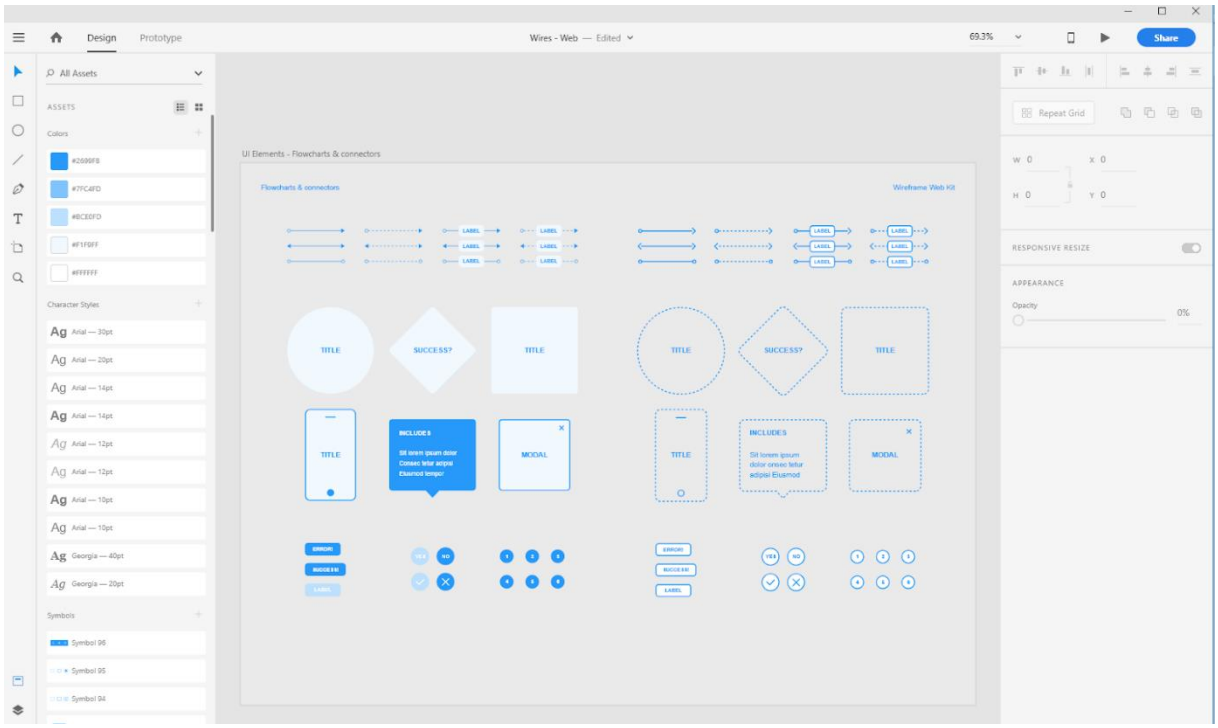

Figure 8. Adobe XD pre-made components

Now that we have a clear view of the current state, we can easily define the problem and the main goals of creating this application. Once we have a clear picture of the current situation, we are starting to create the desired, future state in order to make a better experience for the end users.

After a lot of modifications and discussions, it was decided to use Adobe XD software to create a future UI workflow. Figure *9* presents the user workflow that is consisted of many "screens" and it is divided into a couple of groups. Travel info, Plane, Train, Other, Car, People, Additional info, Hotel, Motive, Summary since the previously used pdf travel document consisted of several groups of information.

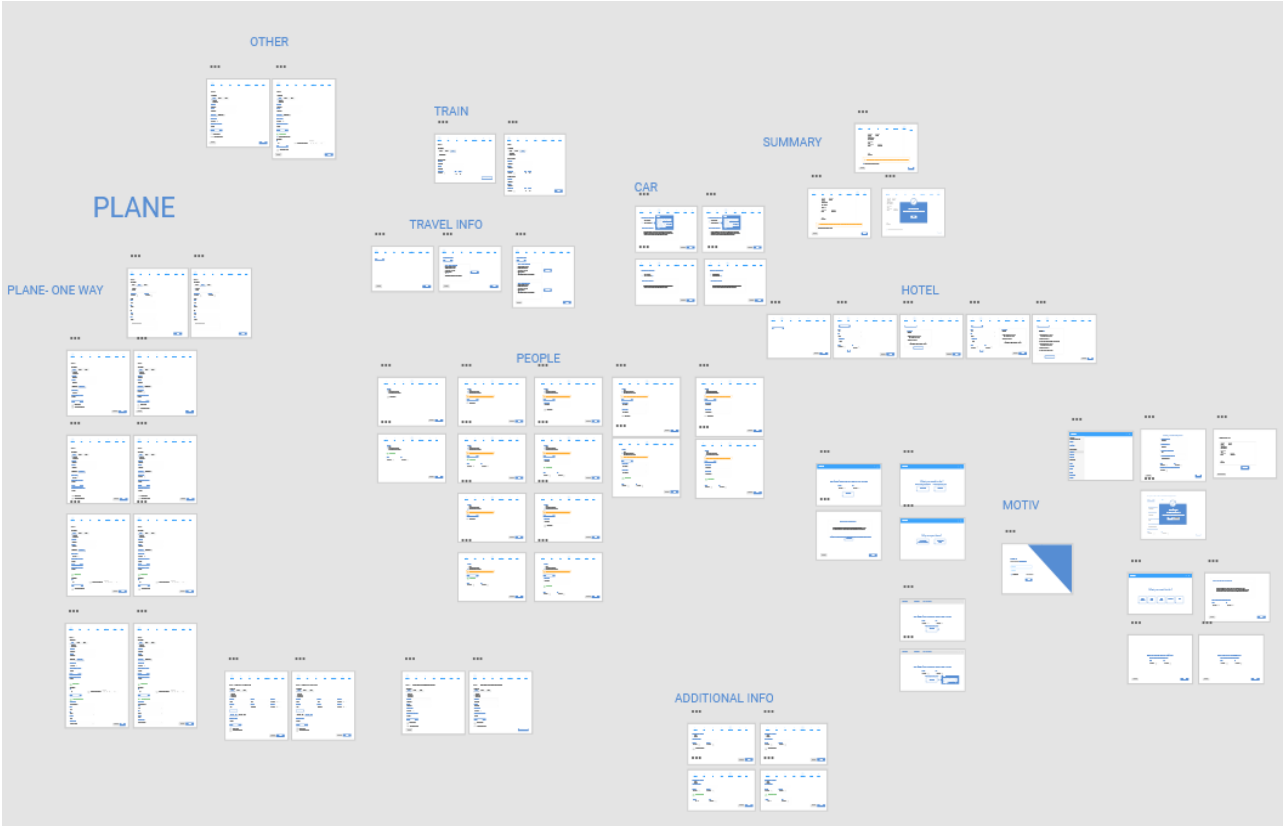

Figure 9. UI workflow - future state

3.2. Designing phase

In the Designing phase, it is time to find potential solutions, generating as many ideas as possible. However, if there are more designers involved in the team, it is not a time for group brainstorming. Everyone needs to produce one or more sketch ideas without the pressure of groupthink. At this stage, various techniques can be used to generate more ideas in a short time. For example, various voting techniques or best choice techniques can be used. Some of the most popular techniques used at this stage are Mind Map, Crazy Eights, Storyboard, Silent Critique, Group Critique, Super Vote and many more. Techniques can also be combined together and performed several times in order to reach the desired results. [8]

According to that and because there were not many people in the team on this project, we used the storyboard technique. For projects where a larger team is involved, it is often used the Crazy Eight technique.

Crazy Eights is a structured sketching exercise in which each member of a team has 30 seconds to sketch eight different ideas of, for example, a component that he wants to include into the project, each in a separate frame on a small piece of paper. The fidelity can be quite low: the sketches don't need to mean anything to anyone but for this team member. It is recommended to do this in two cycles, going around the room quickly after each round to explain what each person drew. In this way, team members can expand upon what someone draws in the next set of 8-Ups and the exercises to come. In the end, the group decides what they want to include in the project.

These techniques are characteristic for the Design Sprint. « Design Sprint is a flexible product design framework that serves to maximize the chances of making something people want. » [9] It is an intense effort (usually lasts for 5 days straight) conducted by a small team where the results will set the direction for a product or service. It consists of five phases: Understand, Diverge, Converge, Prototype, Test. The design sprint is a very effective and quick way of finding the solutions, but it is often a problem for people to single out for 5 days straight for a single project. Of course, if you can't manage to gather your team for a full five days, you can pick just some of the techniques or exercises and do them.

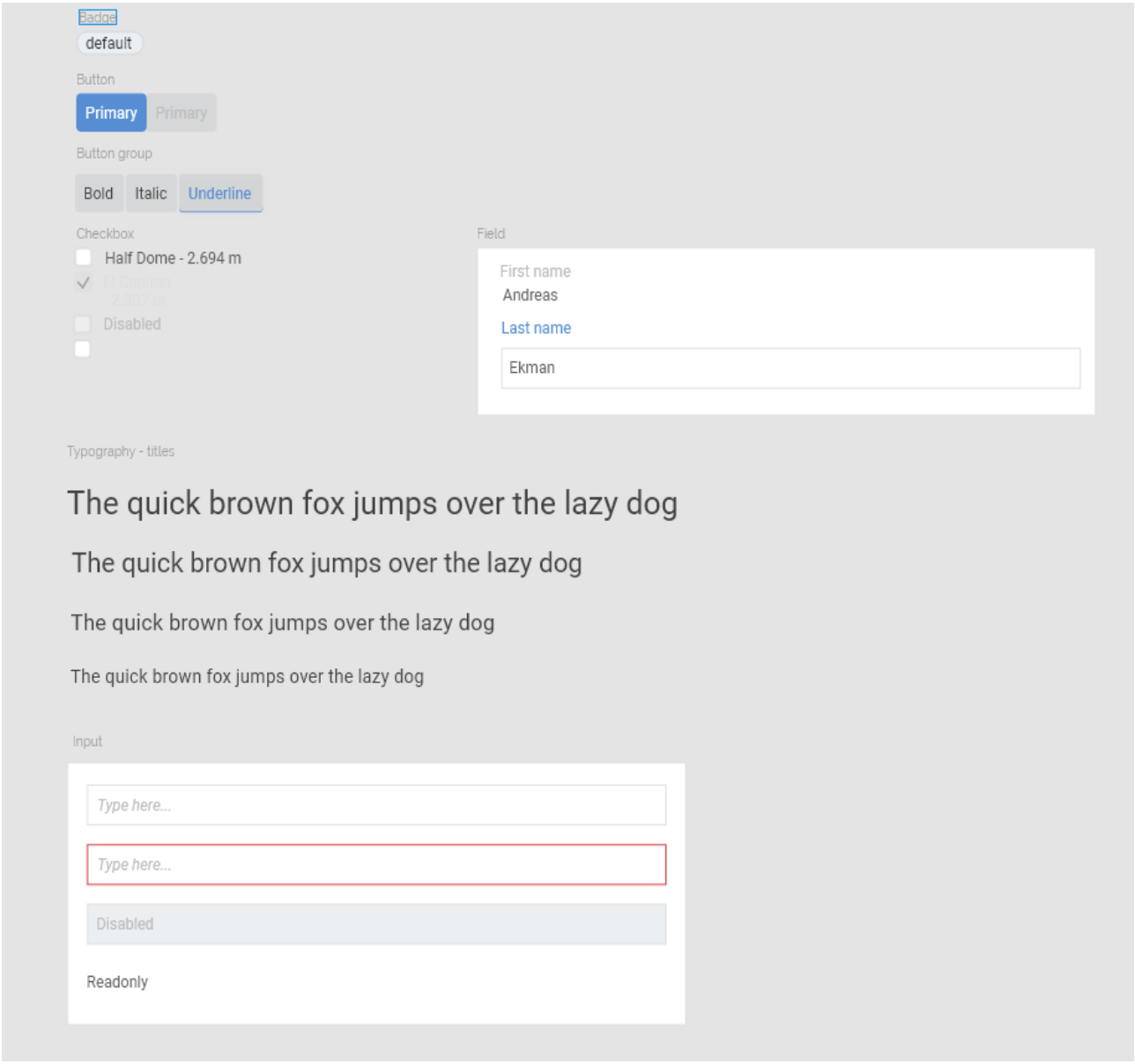

Figure 10. Components of application created in Adobe XD (1/2)

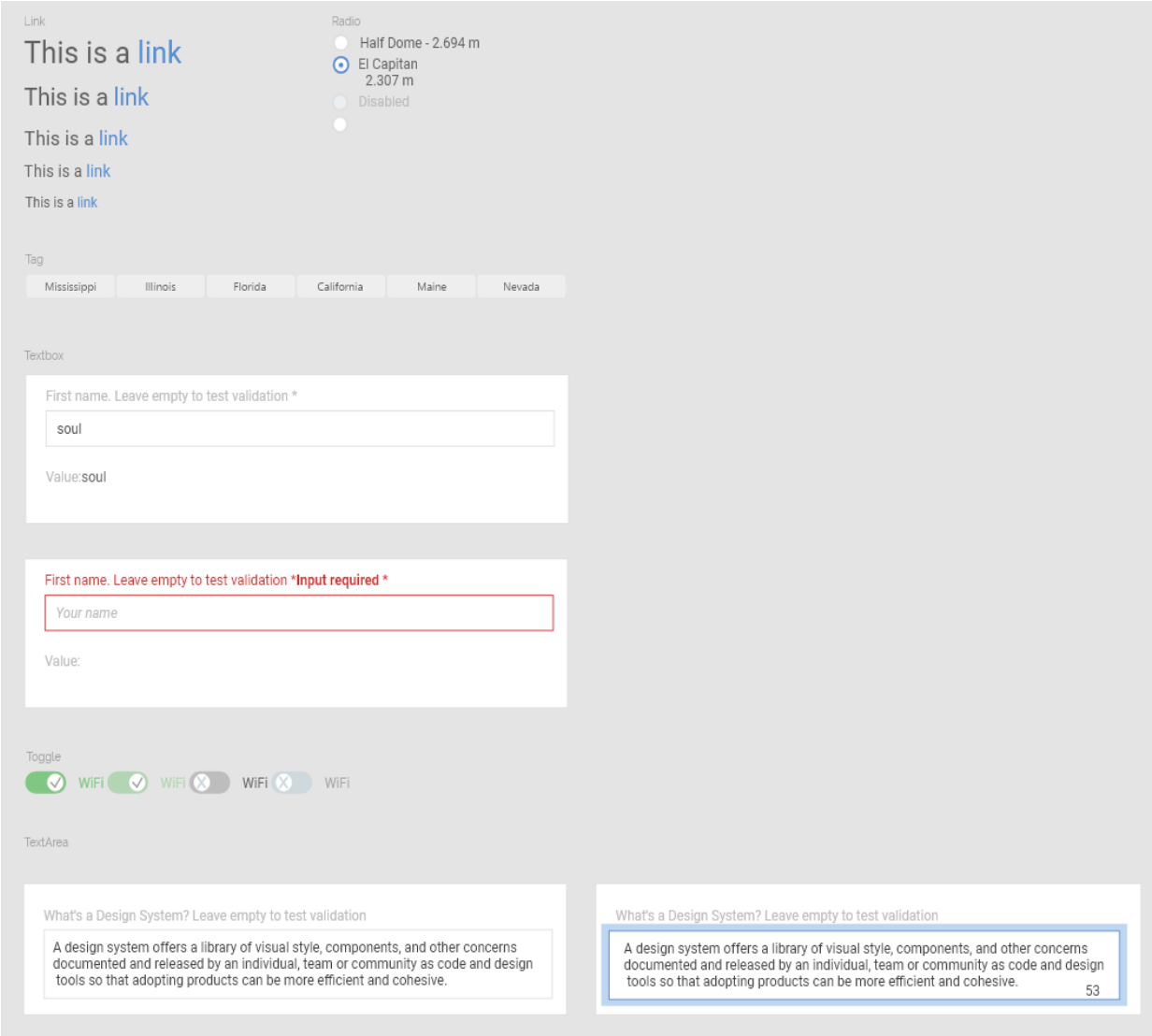

Figure 11. Components of application created in Adobe XD (2/2)

For storyboarding the potential solutions, once again it was used Adobe XD and also a paper and a pencil. Paper and Adobe XD were used to create some of the components we wanted to have in the application we are developing. At first, we created some independent components, as seen in Figure *10* and Figure *11*, and after that, we tried to connect the individual components into a wireframe storyboard, which is a visual representation of a page of application or website that represents a skeletal framework. In this way, we are able to see how everything could look at the end. We repeated this step a lot of times until we were satisfied with the solutions we created. Figure *12*, Figure *13*, and Figure *14* represents one section of a future user journey map that will be implemented when building a prototype.

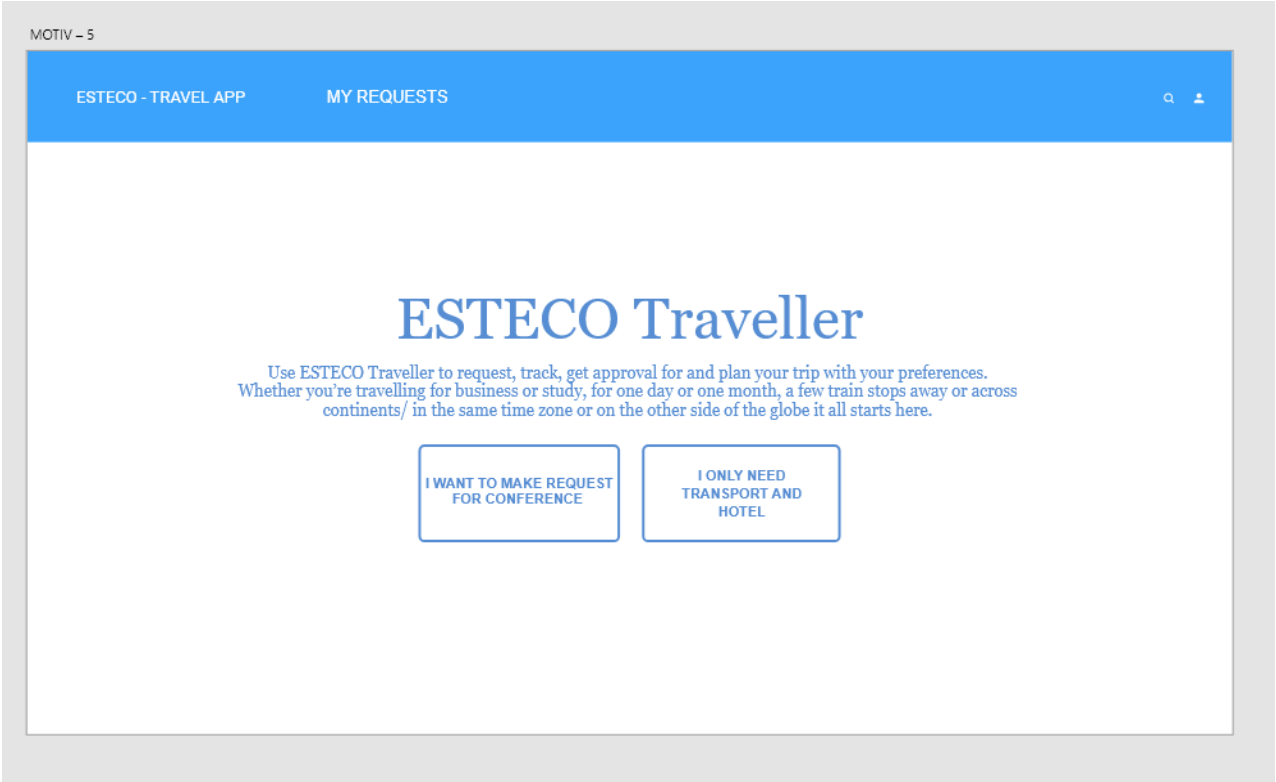

Figure 12. Wireframe of application (possible solution) (1/3)

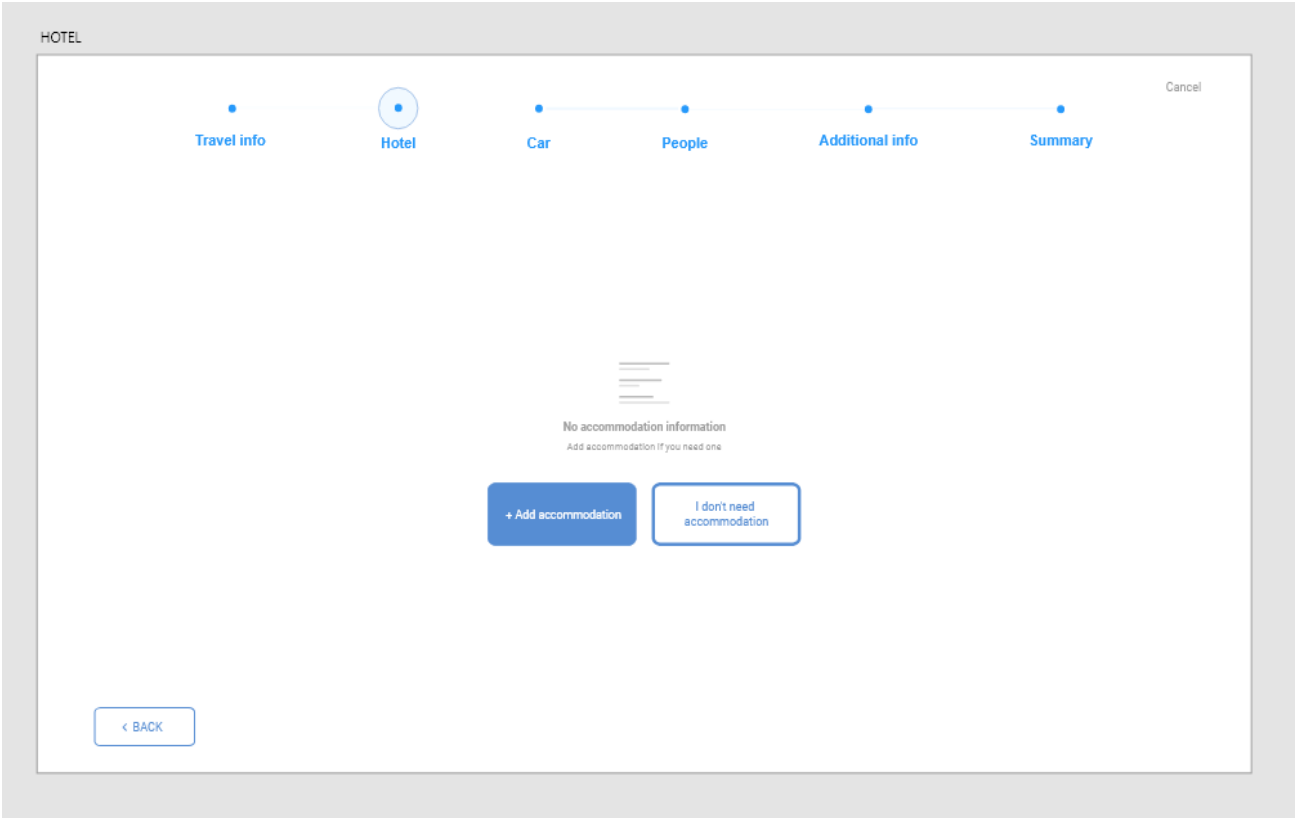

Figure 13. Wireframe of the application (possible solution) (2/3)

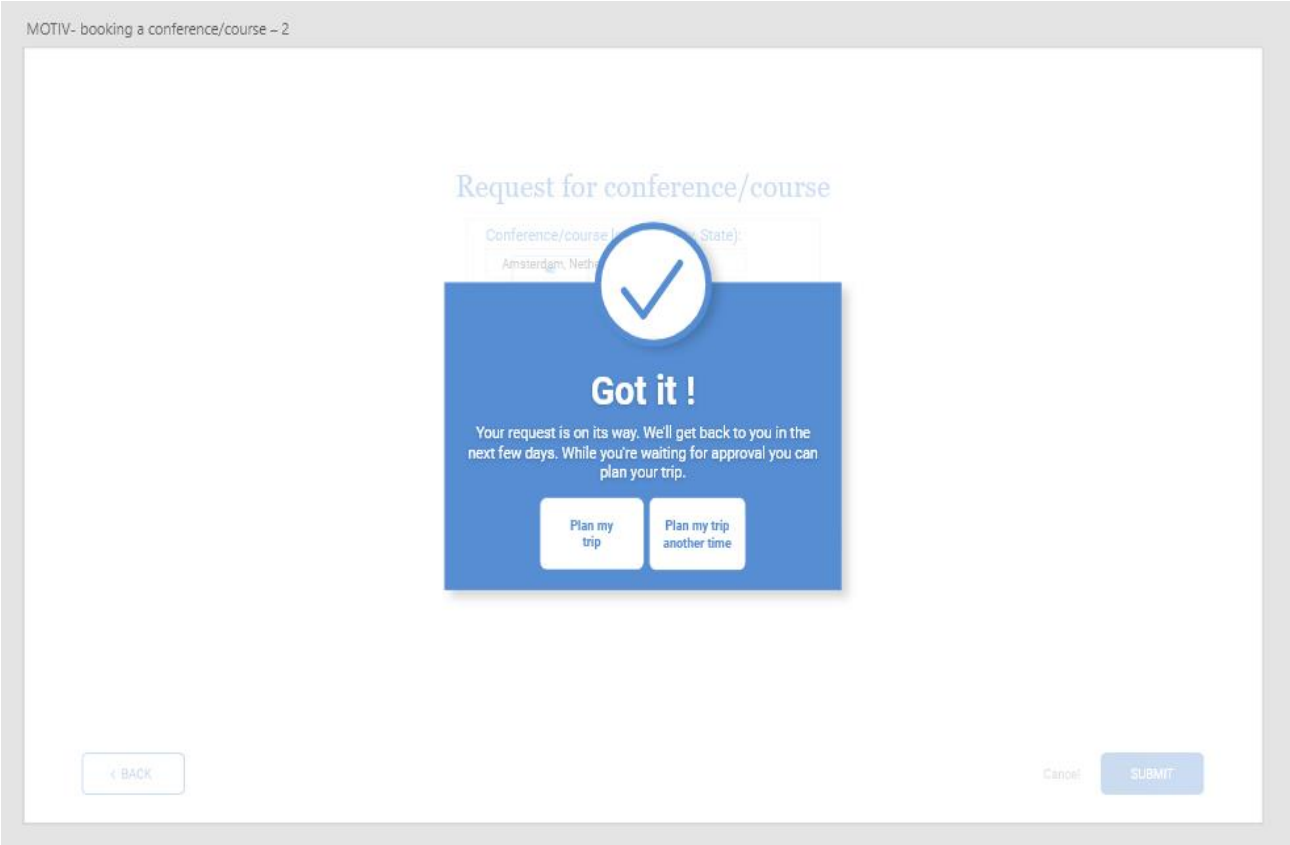

Figure 14. Wireframe of the application (possible solution) (3/3)

In this phase, it is very important to know the rules of good UX design. For example, in which case you need to use a toggle button rather than a radio button, or how the input form should look like, how information should be shown and so on. For someone who is not familiar with the principles of UX design, but is interested in them, the UX Planet website can be very useful, because it is up to date with the innovation in the UX world. Before designing a new product, it is a good practice to visit the UX Planet website, to check what are the latest trends and knowledge in this particular area.

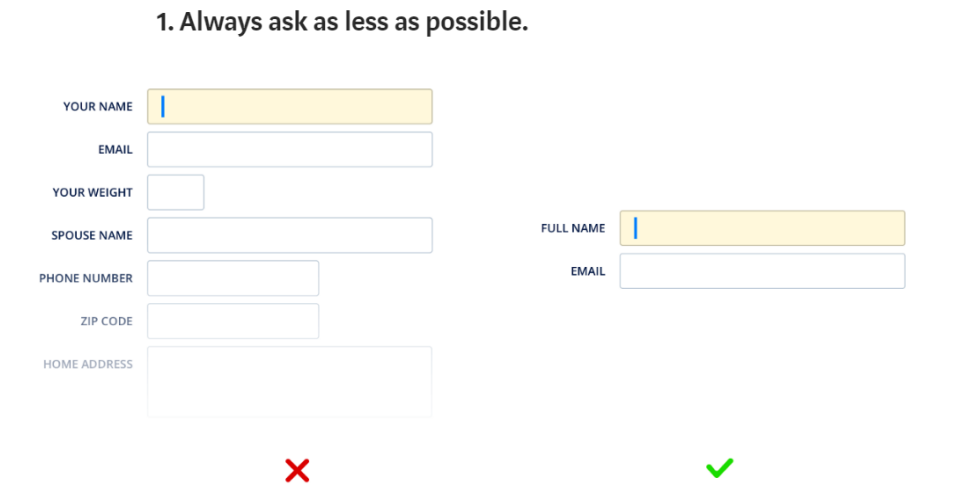

Figure 15. Always ask as less as possible rule (source: https://uxplanet.org/the-18-must-do-principles-in-the-form-design-fe89d0127c92)

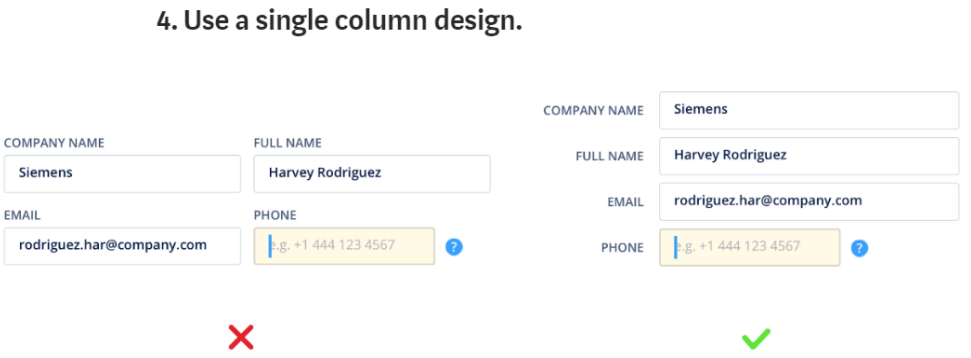

Figure 16. Use a single column design rule (source: https://uxplanet.org/the-18-must-do-principles-in-the-form-design-fe89d0127c92)

Figure 17. avoid dropdown menus if you have less then a few options rule (source: https://uxplanet.org/designing-more-efficient-forms-structure-inputs-labels-and-actions-e3a47007114f)

Figure *15*, Figure *16*, and Figure *17* represents some of the principles that will be considered in this project. For example, some of the important ones that was used here are: “A form should consist of input field, field labels, which should appear on top, structure, action buttons and feedback (notifying the users about the results of their actions)”, “You should avoid dropdown menus if you have less then a few options”

It is a good practice to use a placeholder text to help users with writing the right input, and also to use masked input, for example, if there is a field in which users should input a card of a phone number.

Providing users with a matching keyboard is also a good idea. For example, if the input should consist only of numeric data the better solution is to provide them a numeric keyboard when they click on the specific field. (Figure *18*)

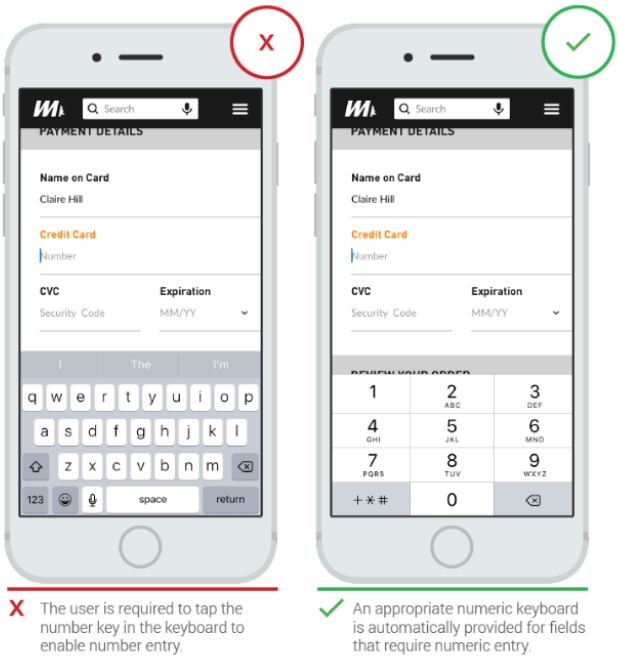

Figure 18. Use masked input and right keyboard rule (source: https://uxplanet.org/designing-more-efficient-forms-structure-inputs-labels-and-actions-e3a47007114f)

When having multiple action buttons, it is important to differentiate them and be consistent with their usage. Meaning, that there always needs to be only one primary button which should be highlighted in some way. Buttons should have different visual weights. (Figure *19*)

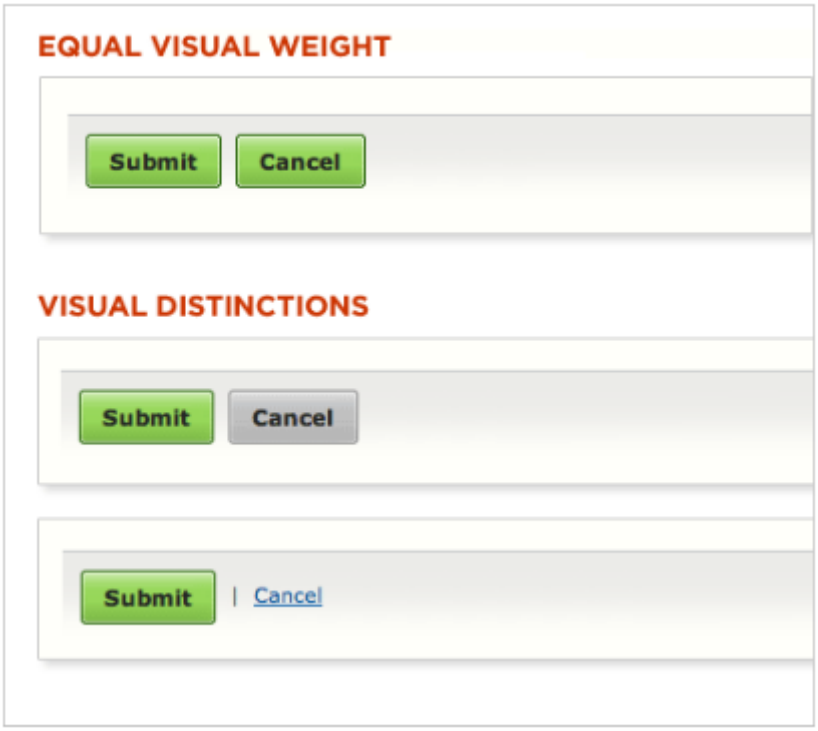

Figure 19. Have different weight buttons rule (source: https://uxplanet.org/designing-more-efficient-forms-structure-inputs-labels-and-actions-e3a47007114f)

Avoiding the reset button is also a good practice because it is almost never useful but instead it can cause a lot of problems if the user accidentally presses them.

A good practice is also to divide the form into semantic groups if needed. This way the users will have a feeling of making progress through the form. (Figure *20*)

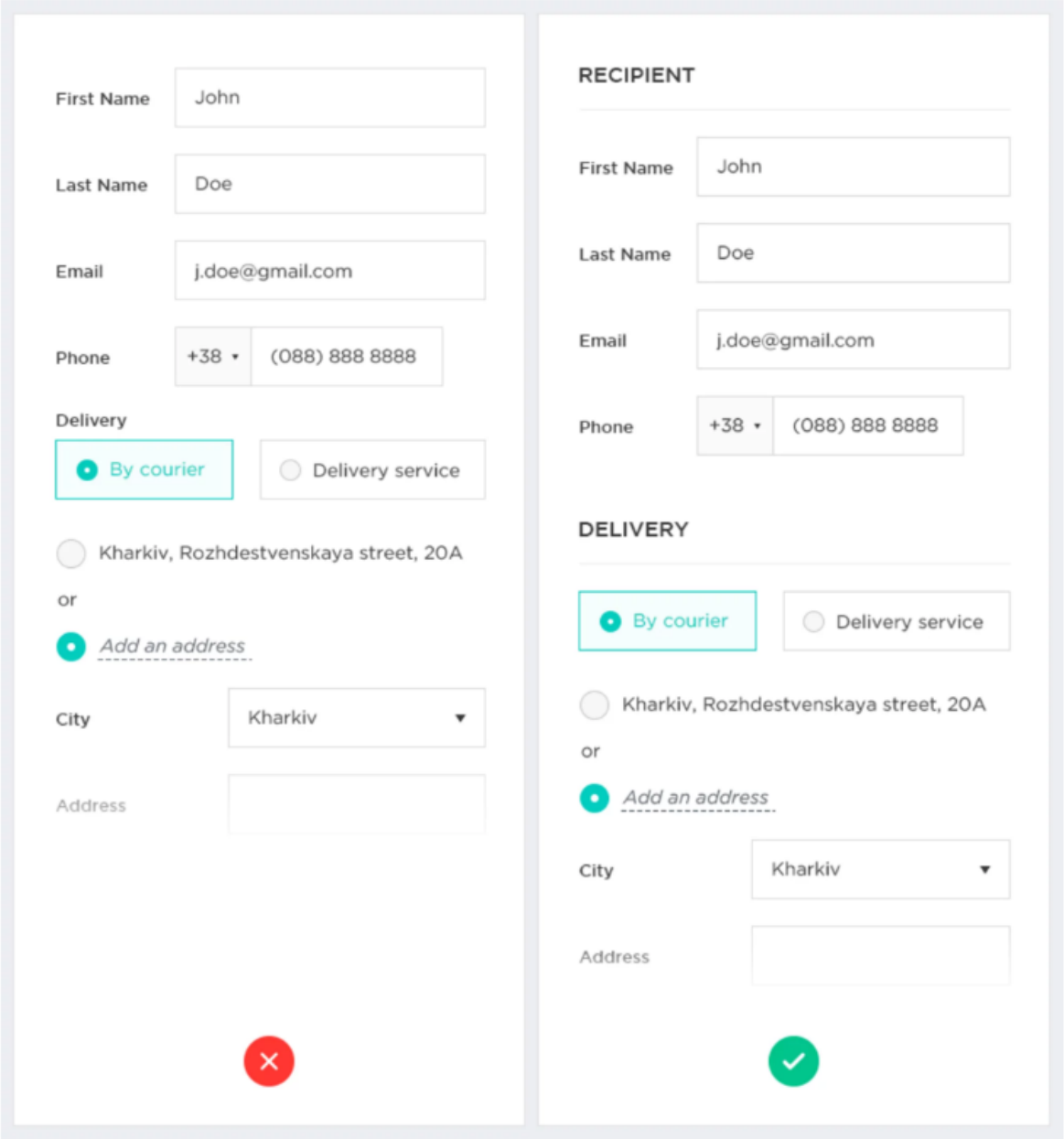

Figure 20. Divide form into semantic groups (source: https://uxplanet.org/the-18-must-do-principles-in-the-form-design-fe89d0127c92)

Some more rules that are good to implement when designing new products are:

- use pre-fill input fields
- use auto-detect input
- use auto-focus
- use constraints for each field

- use visual constraints
- be clear in error messages
- mark optional fields instead of mandatory ones
- don’t take the user out of the checkout process
- enable next-step-button only when the form is filled out
- mind the local differences
- always explain why and what for is it when asking for a specific data

3.3. Prototyping phase

In the prototyping phase, the main goal is to create a prototype of the final product. A prototype could be low fidelity, high fidelity or popularly said: “quick and dirty”. The Difference between low and high-fidelity prototypes is that low fidelity ones are usually not clickable, meaning that links and menus do not work. Often low fidelity ones are black and white and they do not represent visual attributes of the final live system. Whether it is chosen to build low or high-fidelity prototype, they do not need to be perfect but they should deliver wanted information to the user, and also the designer has to be able to test adequately the assumptions his team has made.

Since our goal is to develop an application, our prototype will be an application that will be concentrated on representing the right information to the user in the right way. The created application should be clickable and it should deliver wanted information, also it needs to be easy to use. In this phase we will not concentrate on the design, i.e. we don’t want to make application pretty, but functional and easy to use (at least for now).

A prototype can be created in a lot of different ways. For example, it is possible to prototype on paper, using PowerPoint, Storyboards, Physical objects, Web-based prototyping tools, HTML/CSS, etc. We have decided to use Visual Code studio tool, to create the wanted app using Angular framework, HTML, CSS, and JavaScript.

To develop a prototype quickly, it is recommended and very useful to use the Design System if existed, and since Esteco has one, that is called SOUL, it will be used for more rapid and efficient prototyping. The design system will be discussed more deeply in the next chapter.

If we want to include the existing design systems components into our prototype, we have to install them first. We can install the design system with the line of code shown in Figure *21*.

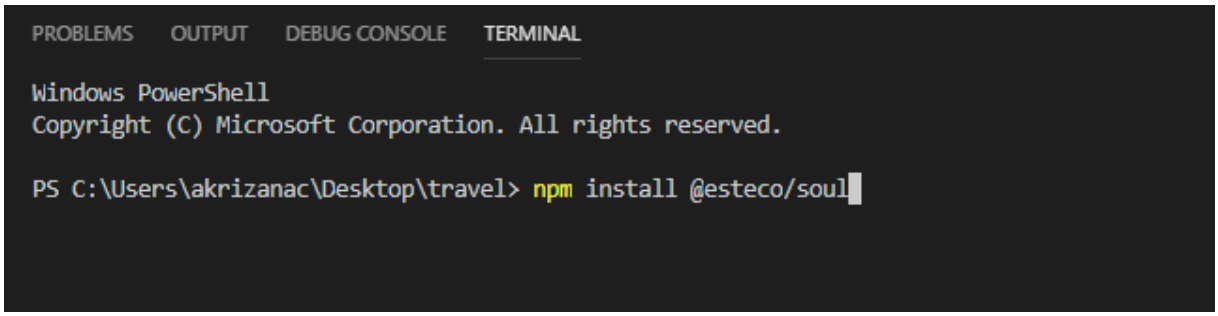

Figure 21. Installing SOUL design system

After installing the design system, we need to manage the packages in the Jason file, and we are ready to go. Part of the packages needed is shown in Figure *22*.

Figure 22. Managing packages in Jason file

Now that we have implemented the design system into our project we can start with building our prototype. First, we start with generating the needed components with the next line

```
>> ng g component people
```

After generating them through CLI (Command Line Interface), we have created a .html, .css, and .ts file of each component. We can then start to code the .html files using the predefined SOUL components, whose outcome look we can find on the SOUL website. An example of a SOUL modal component that we are using in this project is presented in Figure *23*, and Figure *24*.

Figure 23. SOUL modal component code

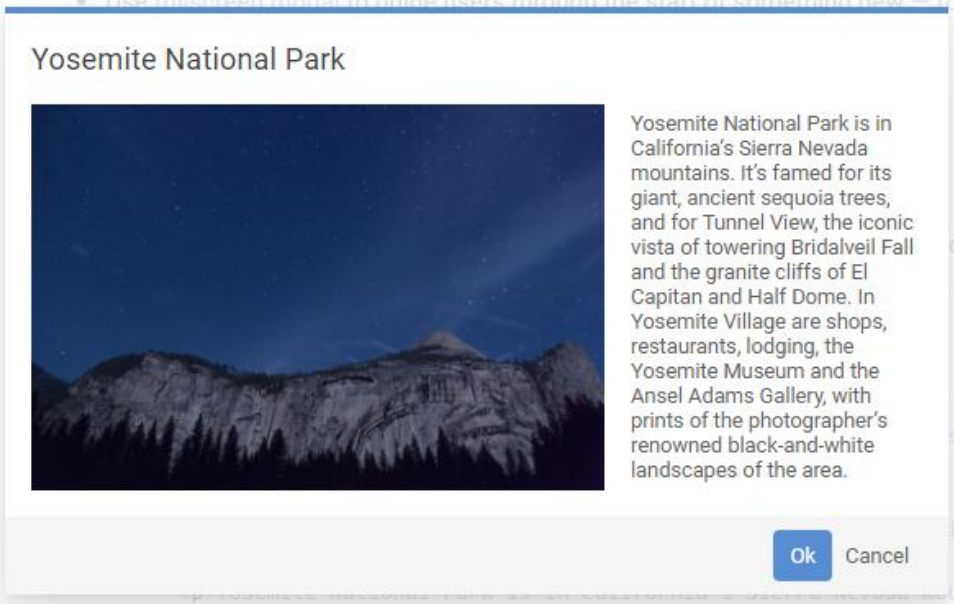

Figure 24. SOUL modal component preview

Connecting the components and giving them functionality with TypeScript, we are starting to have a wanted prototype that we can later test on the real users.

To create a wanted prototype, it is necessary to have a good knowledge of the Angular framework. The angular framework is an open-source framework based on TypeScript used mostly for creating dynamic web apps. It consists of multiple libraries that offer a lot of features and benefits that allow you to implement complex requirements. For example, Angular CLI allows the developers to start building fast, by adding new components and tests. Angular applications are loading code rapidly with the help of a component router, which is responsible for delivering automatic code-splitting so that users can load only the code they requested instead of everything that is written in the code file.

3.3.1. Design system

According to [10] design system is: *«a set of interconnected patterns and shared practices coherently organized to achieve the purpose of digital products. Patterns are the repeating elements that we combine to create an interface: things like user flows, interactions, buttons, text fields, icons, colors, typography, microcopy. »* Design systems are enabling designers and developers to effectively store and document patterns and shared practices that are often used so that they can develop the next product way faster and more efficient. Also, they are helping the developers and designers to have consistency within the design and products.

A design system should constantly be updated and maintained by adding new features, and removing the old ones because standards are constantly changing. Good design is like every other language, and when everyone is speaking the same language, that is when things get done. The same could be said about design systems. [11]

Everyday bigger companies start by introducing the design system into their business. Some of the most famous companies that have their own design systems are Airbnb (Figure *25*), Spotify, IBM, Salesforce, Trello, etc.

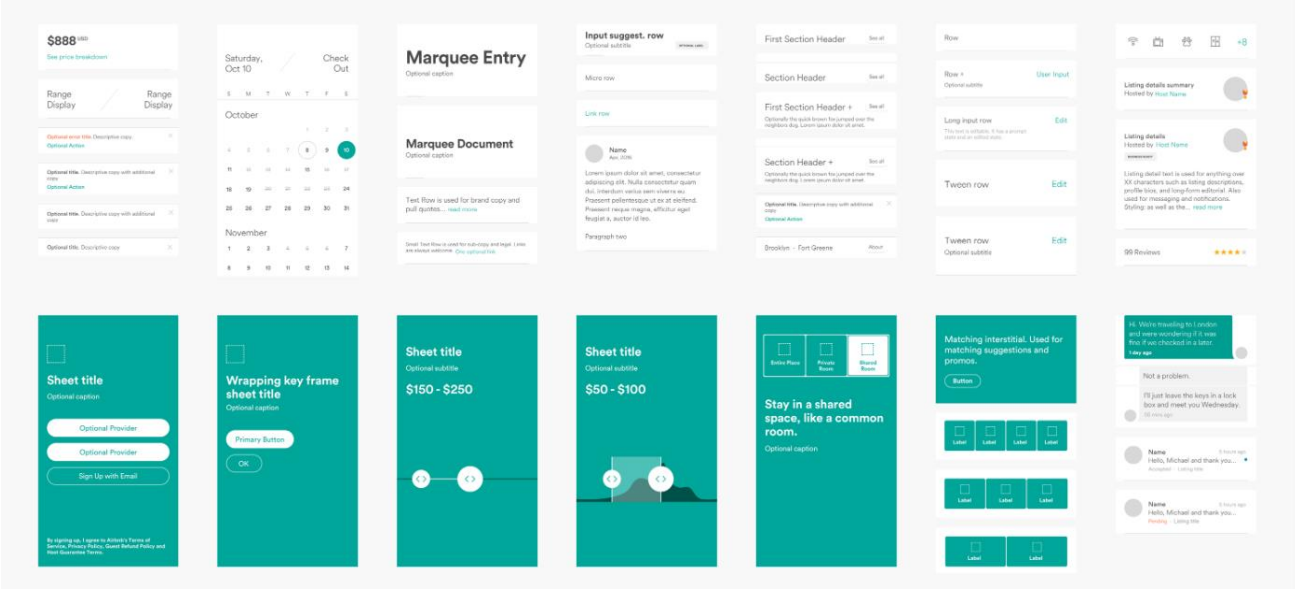

Figure 25. Airbnb's design system

Like the aforementioned company, Esteco, the company for which we are developing the application in this thesis, also has its own design system, called SOUL. SOUL is a design system that Esteco is using to build their own products. That library describes the building blocks that make up its design system. For now, the SOUL is private and not open to the public. Figure 26. shows the homepage of the SOUL design system.

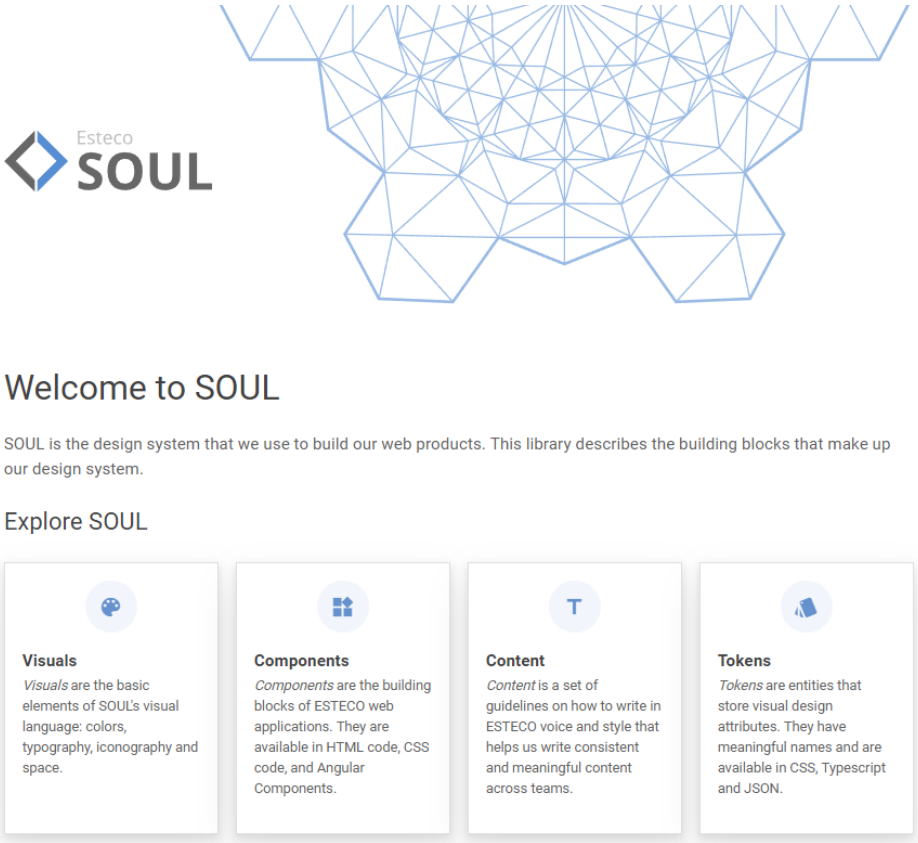

Figure 26. Homepage of soul design system

3.4. Testing phase

From the testing phase, our main goal is to get feedback about our prototype, from our end users. We will not be testing on a finished product, but on the prototype, also as mentioned before we are here focusing on the functionality of a product, not on design. This phase is very important because it tells us if we managed to find the right solution for our problem. The

prototype on which testing will be performed is displayed in Figure *27*, Figure *28*, Figure *29*, Figure *30*, Figure *31*, Figure *32*, and Figure *33*.

Figure 27. Prototype homepage

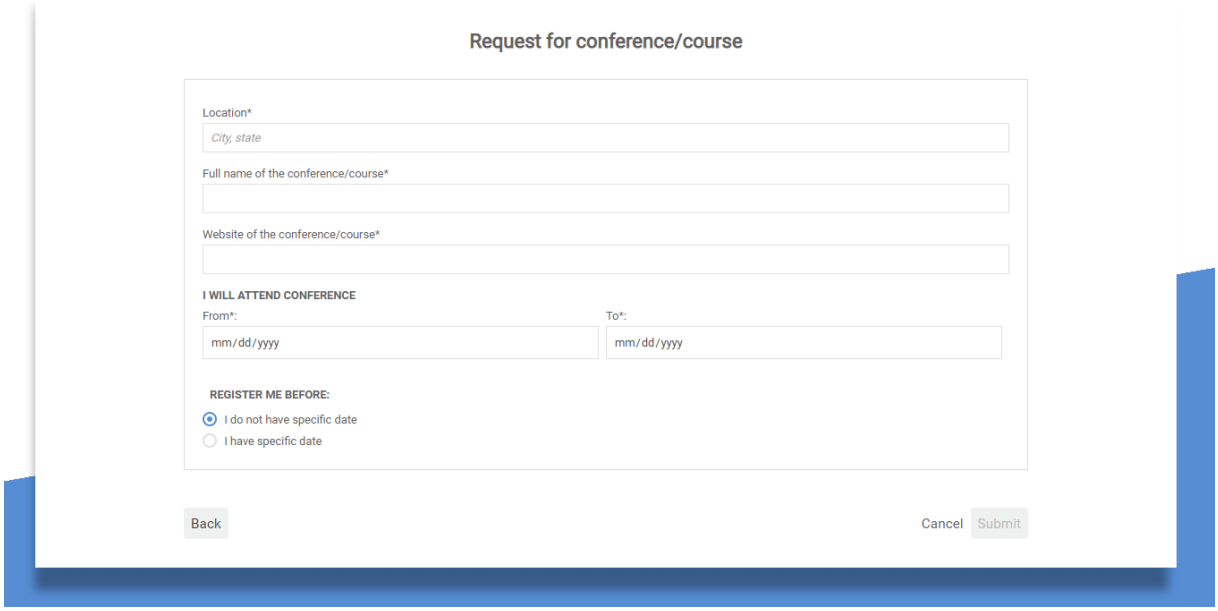

Figure 28. Prototype conference request

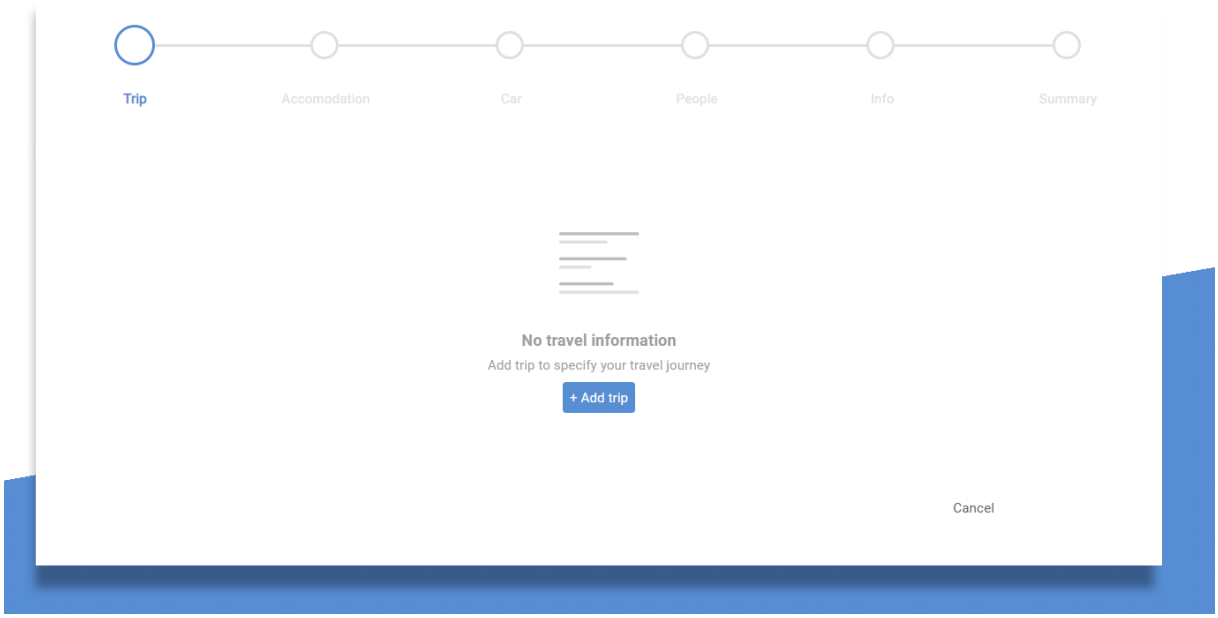

Figure 29. Prototype - travel wizard (trip component) (1/3)

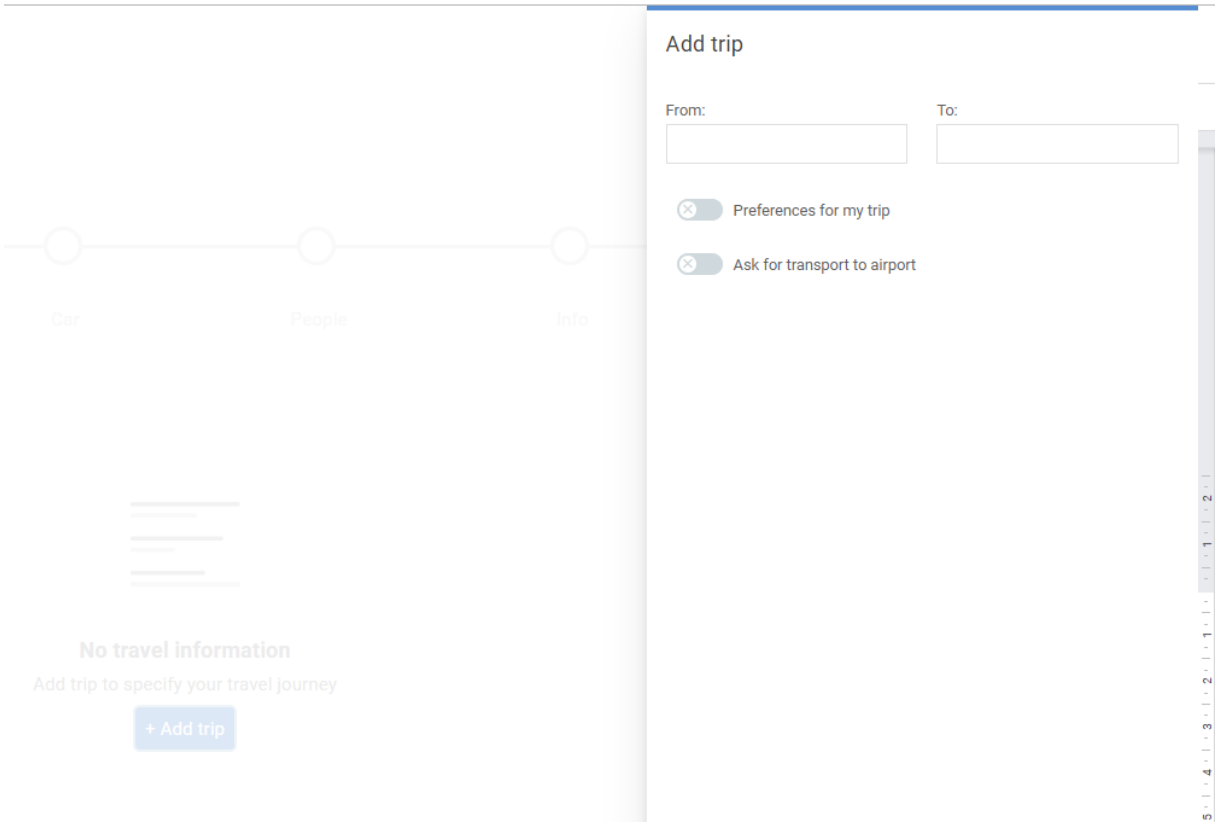

Figure 30. Prototype - travel wizard (trip component) (2/3)

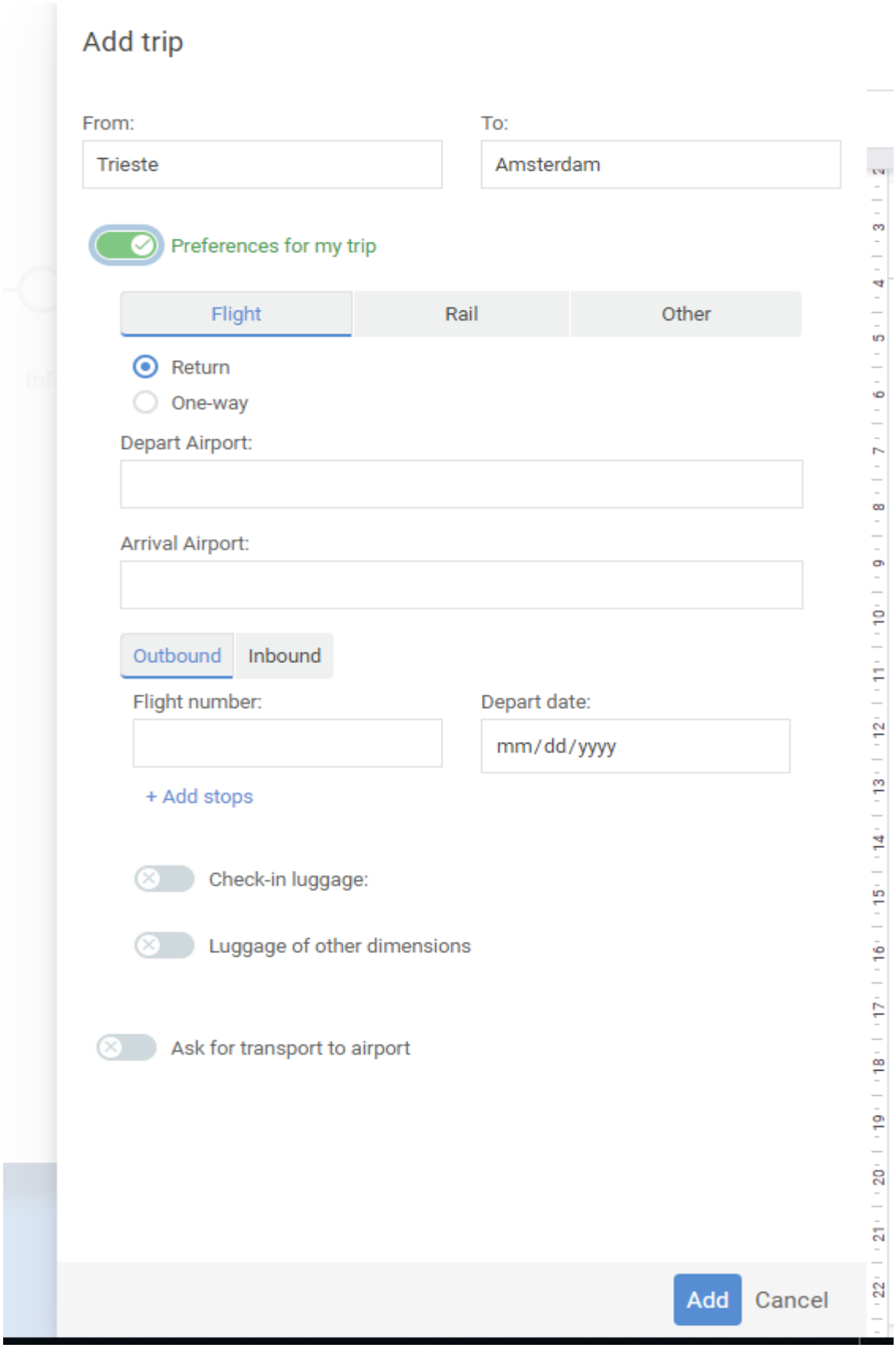

Figure 31. Prototype - travel wizard (trip component) (3/3)

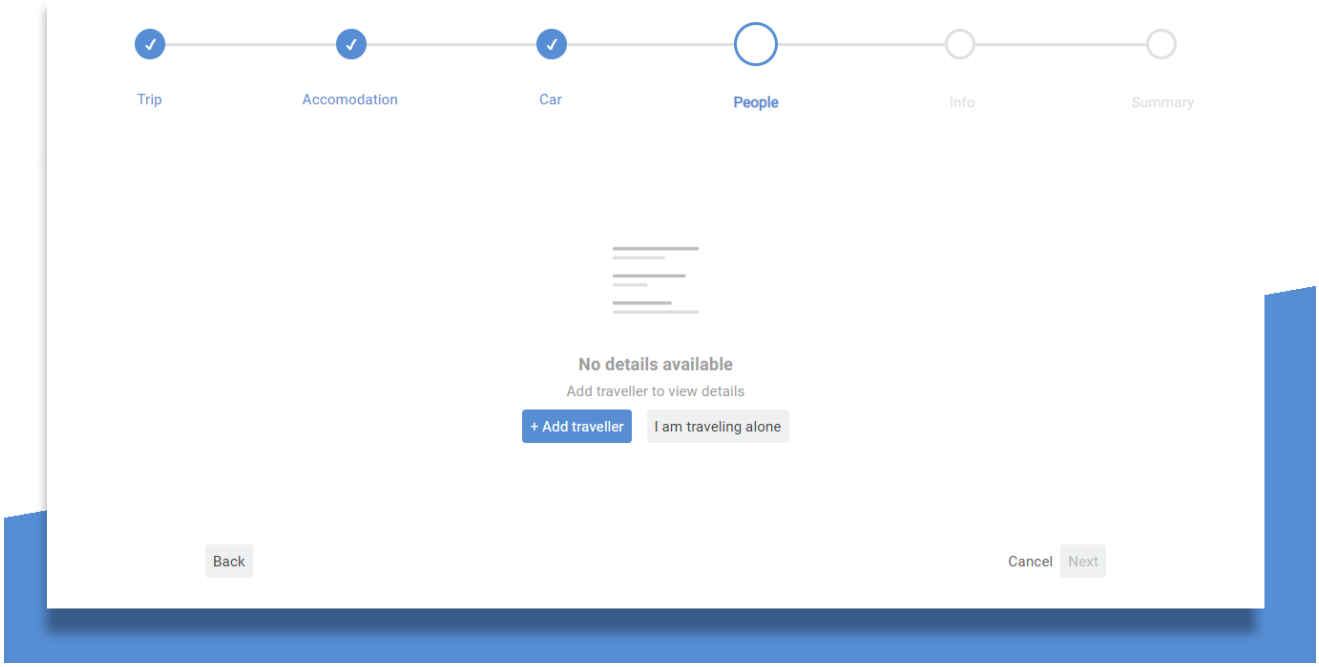

Figure 32. Prototype - travel wizard (traveler component)

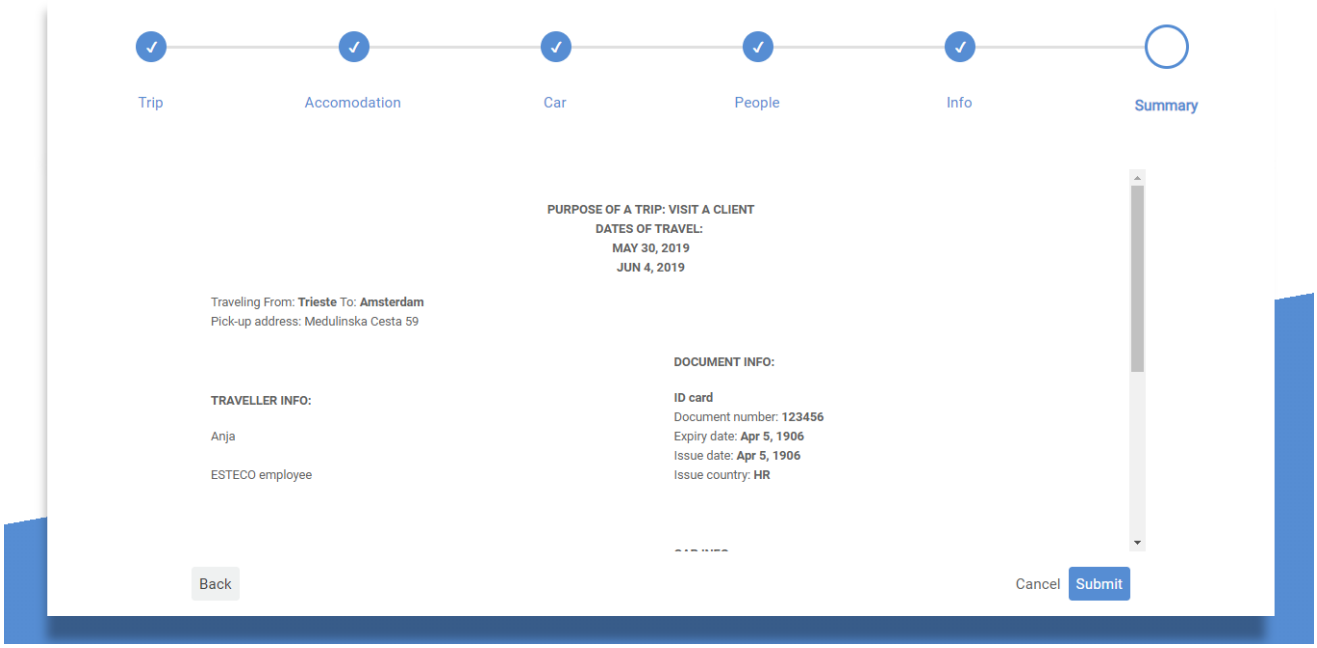

Figure 33. Prototype - travel wizard (summary component)

Before we start with the testing, it is good practice to create some User scenarios. A user scenario is a story that is made up which describes a user's accomplishing a goal or some action

through a product. We created the four most frequent scenarios that will be presented to the users. These scenarios are written as a series of tasks, and below is shown the content of the scenarios.

Scenario 1

1. You're going to a conference called CSS Day in Amsterdam. Conference dates: 12-13/6 2019.
2. You want AT to buy the conference ticket.
3. You want AT to book your flight. You want to arrive to Amsterdam the day before the conference and you want to leave the day after the conference.
4. You need transport to the airport from your home and back.
5. You need a hotel, but you don't have a preference. You just want it to be with breakfast included.
6. You're travelling with a colleague from Esteco

Scenario 2

1. You're going to a conference called CSS Day in Amsterdam. Conference dates: 12-13/6 2019.
2. You want AT to buy the conference ticket.
3. You want AT to book your flight. Flight details:
   11.6.2019
   Venice-Amsterdam
   Flight number: KL1656

   14.6.2019
   Amsterdam-Venice
   Flight number: KL1655

1. You need transport to the airport from your home and back.
1. You need a hotel and you want to stay in IBIS Style. You want it to be with breakfast included.
1. You're travelling with a colleague from Esteco.

Scenario 3

1. You have a meeting in Udine on 16.06.2019 at 11 AM.
2. You want to take the train from the Trieste train station at 8:50 AM.
3. You'll have lunch in Udine.
4. You'll be coming back to Trieste in a friend's car.

Scenario 4

1. You are visiting the Esteco India office.
2. You want AT to book your flight. Flight details:
   9.6.2019
   Venice-Munich
   Flight number: LH9455

   Munich-Mumbai
   Flight number: LH766

   Return: 29.6.2019
   Mumbai-Munich
   Flight number: LH767

   Munich-Venice
   Flight number: LH9454

1. You have one piece of check-in luggage.
1. You need transport to the airport from your home and back.
1. You need a hotel, but you want AT to deal with the reservation.
1. You need 1200 euro advance money.

We decided to start testing on the simpler scenarios which would be scenario one and three. We need to print the scenarios separately and then give one of them to the user. The best method for testing a product is to observe the behavior of the user. Users will get a specific task they need to complete using the designed prototype. In this way, we will find out if the product is working right or not.

When a user is testing a product it is very important that he/she is constantly expressing what is on his/her mind as they are going through the process of accomplishing tasks. Also, it is very important that we, as examiners are not suggesting the "right" solution they need to make or trying to affect their opinion in any way because then there is no point at testing on users. Users body language and face mimic can also tell us a lot about their experience with using the product.

The first user that was testing our application is a woman, who is working in Esteco for several years and has a lot of experience with the travel module that is the current solution for managing travel. She was trying to accomplish tasks of the first scenario. Through her testing,

we find several mistakes and flaws of the product. For example, by mistake, she added information about the traveler that is not traveling with her. She could edit the entered data, but could not completely remove it, because there was not a remove/delete button. The only thing she could do is to cancel the whole process and start again from the beginning, which obviously is not a good solution, so after the testing, we decided to add that delete button. (Figure *34*, Figure *35*, Figure *36*, Figure *37*)

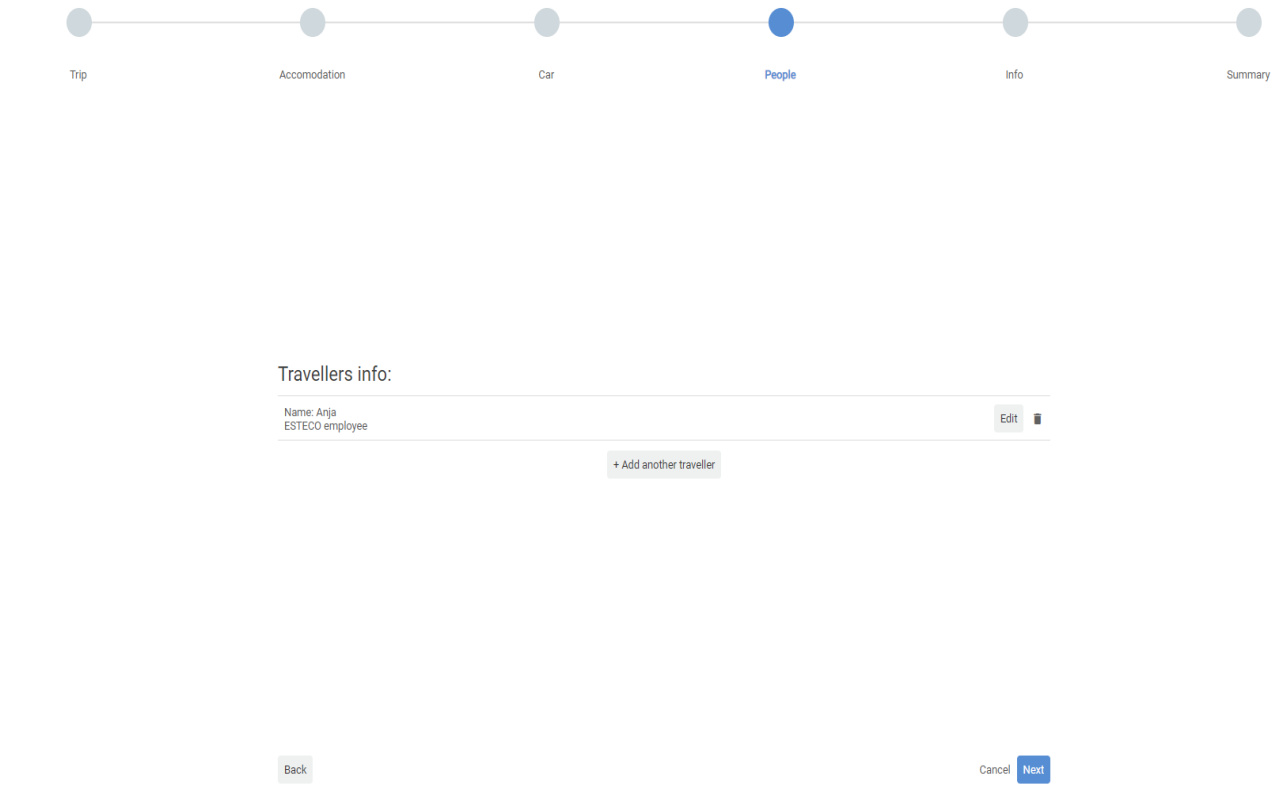

Figure 34. Implemented delete button in the application (1/3)

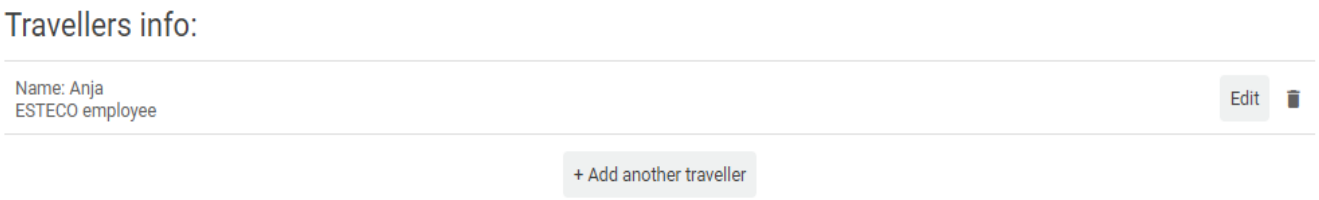

Figure 35. Implemented delete button in the application (2/3)

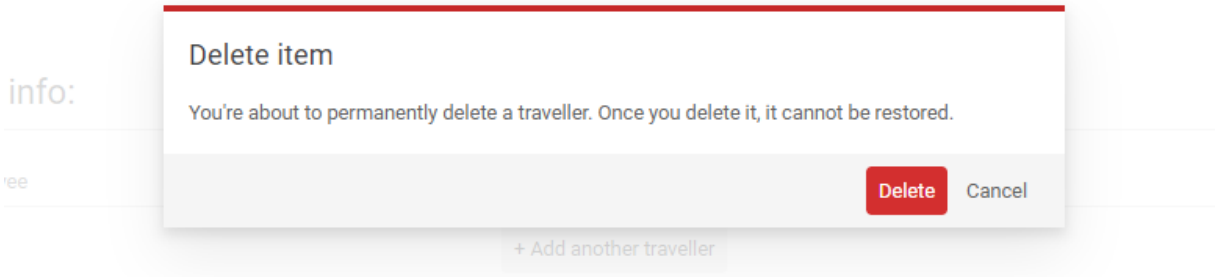

Figure 36. Implemented delete button in the application (3/3)

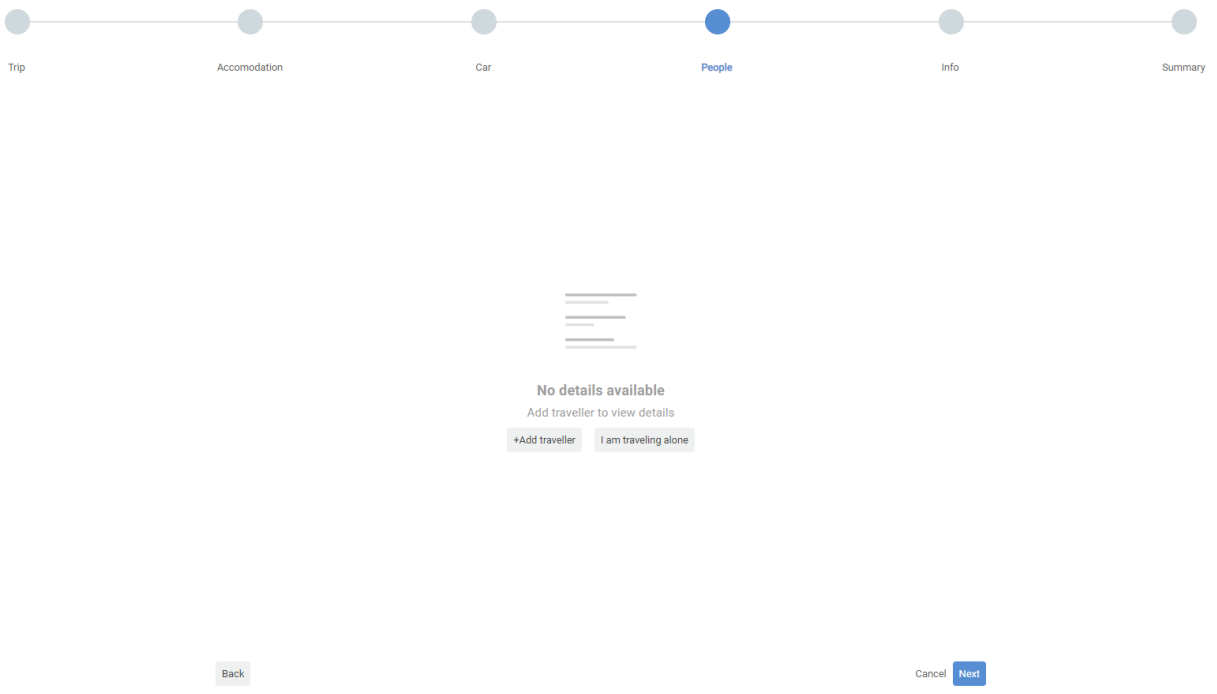

Figure 37. Empty state when adding information about the traveler

Also, trough testing she found odd that there are no restrings through the whole wizard form. After the testing, it is decided to implement that functionality by adding a disabled state to the “Next” buttons if there are some required input fields empty. (Figure *38*)

```
<button class="a-button  a-button--primary" (click)="confirmAddTraveller()" [disabled]="!currentTraveller.fullName">Add</button>
```

Figure 38. Adding required field into code

After the first testing, we decided to try with testing on another employee of Esteco. This time we tested the application on the third scenario. When the user came to the last task "You'll be coming back to Trieste in a friend's car." he got really confused. First, he tried to create a new trip for the return way, but then got confused because he didn't know if the administration should even know this type of information or it is not important for them.

When the problem of this kind happens, it is the best solution to test the same scenario on few more users, and then if the same problem occurred again then we need to find some other solution of representing the information to the users because it is not clear enough.

After several tests have been carried out, if the prototype meets the user's expectation, and designers receive positive feedback, the prototype will be forwarded to developers who will then turn that prototype into a real product that can then be used in practice, and not just for testing purposes.

Since this is a very complex product that is being built, the current prototype is constantly being changed, as more feedback is received. Until the designers' team is completely satisfied with the prototype changes will be happening.

In the end, it could be said that usability testing is always a good idea because it tells the designers if their prototype has met the user's expectation. It also helps them to detect and remove flaws from the prototype. In this way, they can get real feedback about their prototype, so that they can bring the future product to perfection.

4. Conclusion

With the previous chapter, the whole “life cycle” of developing a new product is completed for now. The process of designing, prototyping and testing the prototype needs to be repeated more times in order to develop the final product that will succeed in fulfilling the user’s needs. If in the last phase, the testing phase, was detected some major flaws then it is necessary to start again from scratch because it seems that the problem was not understood well enough. Therefore, if everything went well, and the users are happy with the prototype they were testing than the UX job was successfully managed, and now it is time to forward the prototype to the back-end developers or manufactures so they can finish with developing/creating a real product, meaning that designer job here is done, at least for now.

When trying to improve a process, or when trying to make progress quickly on a project, the recommendation is to start always with the end user and focus on improvements that will provide the most value, as well as to establish the most critical features to focus on first. In this job, key importance is to iterate quickly and share progress regularly across the team and with end users.

The methods that are used in this thesis are not intended solely for designers, they can also be applied in the way organizations develop products, services, processes, and strategies, hence on the workstation itself. In order to be successful, contemporary companies must understand the needs of their customers and must be able to satisfy them. Creating and testing prototypes can significantly reduce the risk and the possibility of failure of a business venture. It also applies to business systems, procedures, protocols, and user experiences. Enterprises must offer their customers an unforgettable experience to create a competitive advantage and highlight, and these methods can make it much easier for them to do so.

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