

BuildingHub: Enhancing User Experience in Building Renovation Process – Phase 3

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ABSTRACT

The European Union's call for reduced energy consumption in the built environment has led to the need for building renovations within the region. Coordinating these projects requires all stakeholders' participation to ensure project delivery. This project aimed to design and evaluate a digital solution to streamline collaboration and improve the user experience of different stakeholders involved in the building renovation process. We used the CUE UX model and selected four experience goals (trust, feeling of being informed, relief, and security) that were verified with four semi-structured user interviews with participants representing two of the target user groups. The need especially for better communication and trust was common for all. Qualitative data analysis utilized affinity diagramming to identify themes and conceptualize design ideas. A wireframe version of the prototype was designed and evaluated. The results indicate that such a platform could likely help in renovation projects, but further studies, iteration, and evaluation are needed to meet the needs of all parties.

KEYWORDS

Renovation, User Experience, Stakeholder Communication, Sustainability, Energy Efficiency, Experience-Driven Design, Human-Centered Design

1. INTRODUCTION

In renovation projects, there are typically several stakeholders involved, and effective communication among these stakeholders plays a key role in completing the project on schedule and with the required quality. Currently, there are some communication channels available, but based on our research, they have their limitations. They cannot, for example, adequately and promptly inform all necessary stakeholders before, during, and after the project. The demand for such a tool is likely to grow in the coming years due to the European Union's energy efficiency goals for the built environment. According to the European Commission (EU), buildings are one of the main sources of energy consumption and

emissions. The Commission has stated that buildings are responsible for about 40% of the EU's total energy consumption and 36% of its greenhouse gas emission. The EU has also set the target to at least double the annual energy renovation rate by 2030 and to foster deep energy renovations. This would mean that in EU approximately 35 million building units, including both residential and non-residential, should be renovated by 2030, and the increased rate and depth of renovation should be maintained also after that, so that EU would reach its climate neutrality by 2050. (European Commission, 2020)

To address the aforementioned needs, the aim of this project was to design and develop a digital solution called "BuildingHub", which enhances the user experience of the building renovation process and involves users better in that process. The solution was inspired by a project called INPERSO and would serve as a central platform for building-related information and user interaction, making building renovations more community-driven. INPERSO has a use case focusing on deep renovations in Spain, but due to practical reasons and resource constraints, we interviewed Finnish people and considered renovation projects more in general. The objectives of the project were:

- 1) to design and develop the digital BuildingHub solution
- 2) to enhance the user experience by providing easy access to building information and involving users in renovation decisions
- 3) to explore user-centric innovation by gathering insights to make building renovations more community-driven.

Several stakeholders are involved in renovation processes, but not all of them can be taken into account in this project due to time and work amount limits. Therefore, the project aimed to tackle the multifaceted renovation challenge by addressing especially the individual needs of residents. To get a broader perspective of renovation projects, we also gathered information from architects, who are one of the key stakeholders in the retrofit process. The project featured the following distinct phases: 1) decision and design (pre-retrofit) 2) integration (during-retrofit) 3) validation and demonstration (post-retrofit).

Chapter 2 of the report introduces the literature related to the topic as well as defines and explains user experience and the UX models that were used for defining and conceptualizing user experience. It also covers experience-driven design and other relevant research for the topic. Chapter 3 introduces the user study and its aims, including the methods used and results from the user study, whereas Chapter 4 explains the experience goals and the design of the BuildingHub. Prototype evaluation is covered in Chapter 5, and discussion of the main findings, limitations and future work can be found in Chapter 6. Chapter 7 reflects our group work. The list of references used as well as appendices are at the end of the report.

AI was used for refining the grammar and structure of our sentences. Additionally, it helped us with translations.

2. RELATED WORK

Our project, BuildingHub, will prioritize communication between different stakeholders in renovation projects. Other important factors are sustainability and how different ways of digitalization have affected renovations. We aimed to mostly have a better understanding of these factors in Finland and other Nordic countries as they would give better insights combined with our stakeholder interviews. In this stage we have used the CUE model which will be discussed in more depth later. Finally, we have used experience-driven design as a tool to better flesh out our project and to especially understand the residents' needs and emotions before, during, and after the renovation project.

2.1 Building renovation

There are many complexities of participatory design in the context of apartment building renovations in Finland. For one, there has been limited interest in participatory research concerning building renovations, despite the potential benefits it offers for collecting residents' views. Different methods include workshops, interviews, and surveys, which serve as procedures for both data collection and user involvement. One of the biggest problems with participatory design is often the minimal resident involvement, especially with physical events like workshops. Residents are a bit better involved when having web-based meetings. The need for more genuine involvement of residents in urban planning development processes should then be emphasized. From this, there are three suggested principles for encouraging user participation in design projects: communication, positive experiences, and follow-through. (Soikkeli et al., 2023) For us, one big take away is "how might we motivate users to participate more actively?" and address the limitations of participatory design due to resource constraints.

Ástmarsson et al. (2013) explored the challenges hindering the development of sustainable renovation in residential buildings in Europe, with a specific focus on the situation in Denmark. A significant portion of Europe's total energy consumption comes from buildings energy usage. The central issue discussed in the article is the landlord/tenant dilemma, where the interests of landlords and tenants do not align, making it difficult to implement energy-efficient renovations. One of the most important findings for us was how regulatory changes and contractual solutions can help address this dilemma and promote sustainable renovation. The need for a package solution that includes legislative changes, financial incentives, and improved dissemination of information was emphasized. Even when energy renovations would greatly decrease the total energy usage, decision-makers like building owners and facility managers often need external motivation to undertake such renovations. (Ástmarsson et al., 2013)

There are existing solutions for creating better communication between the different stakeholders and taking energy efficiency and sustainability into account. Xue et al. (2022), focused on the challenges and solutions related to retrofitting residential buildings for energy efficiency in Norway. They proposed the concept of a

"public-private-people partnership" (PPPP) business model that emphasizes co-creation and collaboration among different sectors to address financial barriers and limited information sharing. The research highlights the importance of citizen participation and suggests that this model has the potential to enhance social acceptance and energy sustainability.

Lynn et al. (2023), explored the transformation of deep renovation in the context of digitalization. In their book, they covered various topics related to the use of digital technologies in renovating buildings, including embedded sensors, building information modeling, building performance simulation, big data and analytics, digital twins, additive manufacturing, intelligent construction equipment, cybersecurity considerations, and financial technology in financing building renovation. From the topics we can get a better understanding of possible new technologies surrounding renovation projects. For our prototype many of these are not directly needed. However, sensor technology can be considered in subsequent iterations of our project prototype.

Finally, we gathered inspiration from Renomination app UX/UI case study. The difficulty of having multiple different stakeholders within the same application is quite hard (Owens, 2019). We can try to diminish that problem by starting to create our prototype with only certain stakeholders in mind. Our primary goal is to get better communication methods between the different groups, and that can be easily muddled if too many stakeholders are considered early on.

2.2 User Experience

User Experience or UX is defined as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service" (ISO 9241-210, 2010, p. 7). As our prototype would be used before, during, and after a renovation project, we needed to first think how we could tackle some of the pain points in designing a product like this. If time would permit, we could have used a long term UX model. However, as we had multiple different stakeholders to consider and limited time for testing in the future, we thought that defining the use cases and scenarios could be better. For this we utilized the CUE model. Thüring et al. (2007) have explained that in the CUE model emotional reactions are strongly presented with instrumental and non-instrumental qualities to create possible consequences of using a product. Designing with the CUE model in mind, the prototype needs to have enough visual aesthetics so that the test users could perceive it to be good and usable. It should also be easy enough to use so that even if the design would be a bit rough from a visual aesthetic standpoint, the usability and ease of use would eventually make it more attractive. This halo effect is something that needs to be kept in mind especially when creating a prototype (Minge & Thüring, 2018). Especially the heuristic side of the design should be well executed to give a good base to possibly build upon in the future.

2.3 Experience-Driven Design

Experience-Driven Design or EDD for short is an approach on how to create good user experience focused designs. The most important

question that EDD always uses is why the users interact with the product and what emotions and needs are involved in doing so. Products overall usefulness, flexibility and interaction methods are also important avenues in EDD. (Kaasinen et al., 2015) Haspel et al. (2022), discussed the relationship between psychological needs and positive user experiences (UX) in the context of human-centered design. They explored experience categories as a design method and their connection to fulfilling psychological needs. Their study identified a consistent relationship between certain experience categories and psychological needs, with competence being particularly relevant in the work context. The identified consistent relationships between certain experience categories and psychological needs in the study were as follows: 1) *Resonance Cluster*: All of the experience categories within this cluster strongly addressed the needs for self-esteem and popularity 2) *Social Support Cluster*: All of the experience categories within this cluster strongly addressed the need for popularity 3) *Challenge Cluster*: All of the experience categories within this cluster strongly addressed the need for competence 4) *Engagement Cluster*: The experience category "Solving a Problem" most strongly addressed the need for competence.

These findings indicate that certain positive experiences, as categorized in the study within different clusters, are closely associated with specific psychological needs. For example, experiences related to social support are linked to the need for popularity, while challenging experiences are linked to the need for competence.

3. USER STUDY

Our user study focused on the design of a solution aimed at facilitating smoother renovation building process for residents and enhance the communication efficiency among stakeholders. The primary objective of this study was to gain a comprehensive understanding of the needs and preferences of those who have experienced the renovation process. Through a combination of desk research, user interviews, observations, and data analysis, we aimed to uncover valuable insights that would inform the design and development of the proposed solution.

For this project, we focused on the Nordic region market, particularly Finland, due to restricted access to participant recruitment. Accordingly, we recruited interviewees from our network and different social media platforms and conducted interviews with the participants. The participants' background comprised of four Finnish males aged 35 to 40 with diverse fields of occupation, such as, information technology, translation, and architecture, and their subjective tech-savviness was 4 or 5 (on a scale from 1 to 5).

3.1 Methods

In the context of methodology, we employed the mixed methods approach to gather diverse insights from the target user groups. As a result, these are methods that were utilized:

- a. *Semi-structured interviews:* We specifically targeted residents who have firsthand experience with the renovation process to ensure their insights were grounded in practical knowledge. Moreover, we interviewed one architect because they play a crucial role in extensive renovation projects, involving design, project planning, and close collaboration with different stakeholders like construction workers and electrical engineers during the project. Gathering the insights from the architecture interviewee helped us to further create holistic solutions to resolve the problems. This decision was based on the recommendation of our contact person within the INPERSO project, who highlighted that architects often have a broad understanding of deep renovation projects. This diverse selection of participants allowed us to gather insights from both the users' perspective and an expert in the field. In total, the interview pool consisted of four participants, which included one pilot interview and three real interviews. Each interview was carried out online with at least a moderator and one observer present, and they were recorded (video or audio only) with the participant's consent. This collaborative approach ensured that we captured a holistic view of the interviewee's experiences and perceptions. Semi-structured interviews were chosen as they enable open-ended exploration of participants' experiences, attitudes, and expectations, aligning with the principles of user-centered design (Norman, 2013). The interview questions are presented in appendices A (residents) and B (architect).
- b. *Observation:* During each interview, at least one observer was present to document user behavior, give a hand for the technical issues when needed (video/audio record, time reminder) and to take notes.
- c. *Data analysis – Affinity diagram:* The qualitative data collected from the interviews was analyzed using an affinity diagram (see Appendix C). Affinity diagram process is benefit when we want to make sense of user insights which are gathered during the research (Dam & Siang, 2022). This method was chosen for its ability to identify common themes, pain points, and user preferences in an organized and visual manner.

In summary, by conducting interviews with residents and an architect, alongside observational data collection, we ensured a holistic view of the renovation building process. The choice of the affinity diagram as the data analysis method was because of its suitability for organizing qualitative data into actionable patterns. These methods collectively offer a solid foundation for our user study, enhancing the likelihood of creating a BuildingHub that effectively addresses user needs and improves the renovation experience for residents.

3.2 Results

We wanted to get a better understanding of the user groups, their needs, preferences, and feelings evoked during each phase of the renovation project. We also aimed to identify the negative experiences and come up with ideas to make the experiences positive or at least improve them. For these, based on the analysis, we created a user persona describing the residents (see Appendix D). The persona describes a resident that is also a member of the housing cooperative. He's 38 years old, has been working in the IT field for several years, and lives in a row house with his wife and two kids. He prefers to use a laptop for complex tasks and for collaboration with other parties involved in renovation projects. We did not create a user persona for architects because we only interviewed one and decided to design the prototype mainly from the residents' point of view due to time and other resource constraints.

An experience journey map (see Appendix E) was also created based on the data collected to get a better understanding of users' behavior and experiences in general. An experience journey map is a more generalized version of a customer journey map: it is a chronological visualization of the overall end-to-end experience that a "generic" person goes through to achieve a goal (Gibbons, 2017).

Based on the interviews, money is usually the leading factor in renovation processes, and energy efficiency related issues do not have that big of an effect. Additionally, the needs may vary, but in general, residents want to have a healthy, comfy and nice-looking home to live in and expect the renovation project to stay on budget and on schedule. Some regulations and space limitations may affect the possible renovation options and result.

The residents feel a lot of concern in nearly each phase of the renovation process. This is usually either due to lack of trust or communication. Communicating especially with the superintendent (a representative from the housing management agency) is considered very often as a challenge both by the residents and the architects. Architects would like a better way to communicate directly with residents if needed. Additionally, finding a trustworthy construction worker is also a big issue, and even the recommendations found online can be fake, meaning created by the company's owner or workers and their friends. Contractors often also use subcontractors etc. who may not be that motivated to work on the task. Additionally, residents are not always clearly informed of the stage of the project and possible issues that arose. They must be active and visit the site often to see the progress and possible problems. In addition to concern, these things also cause tiredness, exhaustion, and frustration even though the residents would like to have a smoothly flowing, easy renovation process – to be able to trust that everybody does their part with good quality, within the given timeframe and without (significant) extra costs. The difficulty of comparing offers also causes some stress and concern.

After the renovation project residents are usually relieved one way or the other. Either they are happy and relieved that the project is finally over no matter how it went or that everything went quite nicely after all.

4. DESIGN EXPLAINED

4.1 Experience Goals

Based on our desk research, literature reviews and empathy towards our target groups, we initially identified five tentative UX goals (completion, relief, relatedness, security, and self-esteem) for all stakeholders in the project. With the user study results analysed, these goals have been refined, bringing them down to four. These goals reflect only the experiences of the residents during the three phases of the renovation project work and are aimed at addressing their needs and pains. The following are the chosen goals:

- *Trust*: One of the factors for making or taking decisions is reliability/trustworthiness of information provided. In the context of the project, we want the resident to have confidence in the information available for them to be able to make sound judgments of offers, contract agreements, construction company selection, etc.
- *Feeling of being informed*: During the pre- and post-retrofit phases, a lot of activities take place which may be challenging for the resident to always visit the site due to personal commitments or them having to make the call. However, they still need to be updated on happenings by other stakeholders (e.g. construction company, superintendent and architects). We want the residents to be aware of what has happened/what is happening, who is doing what and when.
- *Relief*: For the resident, many concerns and uncertainties arise during renovation projects, from choosing the contractor to work with, staying on budget, and staying informed of project schedules and milestones. The residents want to be free from these tensions as much as possible. Additionally, residents want to have the feeling of accomplished work and proper ending, which creates relief.
- *Security (safety)*: The safety of the residents, construction workers etc. is important during renovation. All the parties want to feel that they are safe and that all the data and access to the building/apartment are securely handled. In addition, residents want to feel that their home is a safe and healthy place to live, meaning there are no health-related issues, like mold, in the building/apartment. It is also essential to keep in mind other people who are not involved in the project but may be affected by the work done, for example, other residents living in the area. The responsibility of safety lies in the hands of the project coordinator but the project

sponsor, the resident, also has the responsibility of knowing the safety measures in place.

4.2 Prototype Design

After defining the four experience goals, we decided to create a digital platform that would serve as a one-stop solution for residents and stakeholders involved in the renovation project. Throughout the design process, we considered UX experience goals to ensure the platform would meet the expectations of especially residents. All parties involved in the renovation work would be able to access the system to streamline communication, share information and to ensure project delivery. However, the focus for the prototype was on the residents.

Prototype concept & user flow

The concept for the prototype was a digital platform that would be responsive and accessible through the internet from a web browser on a laptop, reducing the need for any specific system or device compatibility. The features of the prototype were ideated and designed based on the insights gathered from the user study and are shown in the user flow (see Appendix F).

Sketches & wireframes

For the prototype, the team used Figma and started with initial sketches and wireframes, focusing on the platform's layout and key features. Thereafter, more features and wireframes were added to make an interactive prototype. For the initial wireframes and the link to the prototype, see Appendix G.

To build trust in the first phase of the renovation, meaning the before phase, we included a page where the residents could search for a reliable company to work with. We included some filters like offering, location, and rating, and added company cards that would provide more information about the companies and their trustworthiness. With the trust, we also focused on information transparency. We provided a system that all stakeholders can update and share project details with images and documents. This transparency was reflected in the platform's design through clear and efficient dashboard. That dashboard includes, e.g., some main features that can be used to address the user's pain points during renovation projects.

With the feeling of being informed, we recognized that residents usually miss updating information about the ongoing project. The dashboard tries to meet this need as well, but in addition, we created the calendar and notification system, so residents are always informed of any events happening on certain days and of created tasks. A dedicated message feature allows residents to ask questions and get immediate responses from project stakeholders.

With the relief goal, we integrated the visual progress status, allowing residents to see the project progressing at a glance. Additionally, all small tasks from projects are visible on the tasks section with the status of either to do, in progress or completed.

These features aim to reduce anxiety and provide a sense of accomplishment throughout the project.

Finally, to ensure the safety of all parties involved, we provided the messages functionality for residents to report safety concerns immediately, and other parties can update any important information related to the project. Furthermore, we also created the team page, where residents can see all parties' names and positions involved in the project, and also a documents page, where they can see and manage who has access to which file.

The prototype was built using the MVP model focusing only on key features that address pressing needs of the residents as well as the consideration for evoking positive experiences. The platform's visual design would be carefully crafted to support the unified solution for all stakeholders, particularly residents, for enhancing communication, transparency, and overall project satisfaction.

Prototype development

Based on the prototype evaluation, an iterated, high-fidelity prototype was to be designed. That way, the design aspects of the prototype could also be tested.

4.3 User Scenario

Tero just got his first-ever owned apartment through the housing cooperative, and he is embarking on an extensive bathroom renovation. He signs up on the BuildingHub platform with his laptop to start a new project. On the web service, he invites the superintendent of the housing cooperative to join the project. He searches for reliable construction companies based on for example location, offering and ratings. He contacts a few construction professionals for proposal/offer submission and can review and make a selection. He is also able to see/know sub-contractors working for the main construction company. Through the platform, he can see for example the contract, renovation plan, electricity and piping plans as well as the project schedule provided by the professionals, and he is also able to supply needed information. As the renovation project commences, he is informed of the activities ongoing on the site, hurdles, etc. through email notifications from the BuildingHub portal. When he notices some poor work quality on the project site, he can then through the portal, inform all the parties involved in the project and add images for evidence, clarification, and documentation. Once the project is verified to be complete by all parties, a feedback form is sent to everyone to provide input about how the project went.

5. PROTOTYPE EVALUATION

5.1 Methods

We had one evaluation phase with an MVP version of the interactive prototype, which is in Appendix G. Basically, it was an interactive prototype that comprised of wireframes. Five (5) participants aged 35-51 participated in the evaluation, and one of them participated also in the user study. They all had at least some

prior experience with renovation projects, and 4/5 were females and one was a male. Their occupation varied from student to teacher, translator, and nurse. Their technical skills were mainly a lot more limited compared to the users we had in the user study phase. At least two of our group members were present in each evaluation, that was conducted online via Teams and recorded with participants' consent.

For the evaluation, we used basically two methods: an expert walkthrough and a shortened version of the meCUE questionnaire. The script of the evaluation including, for example, all the tasks used in the walkthrough, link to the meCUE questionnaire, and post-interview questions (related to the walkthrough) are in Appendix H.

To obtain qualitative data, we used expert walkthroughs – and by an expert, we refer to being an expert in the role of a resident. There has been evidence that people who are experts in their work domains can be as useful in evaluating a product in this way as a more traditional user experience expert (Følstad et al., 2010). These walk-throughs consisted of four tasks done with our interactive prototype (the participants shared their screens while doing the tasks) followed by a short discussion after each task. Those tasks tried to especially measure how our prototype manages to meet our UX goals but also to get a deep insight into the participants' minds and feelings towards our prototype. After all the tasks, the participants filled in a questionnaire (more about that later in this section), after which we also had a brief post-interview and overall discussion. We had hoped to save some time by doing a group-based walkthrough, but due to scheduling issues, we had to do walkthroughs with one participant at a time. This helped us also gather more data with which to iterate our prototype.

To get some quantitative data, we used a shortened version of the meCUE questionnaire (Minge, n.n.), as we also had some design principles taken from the CUE model. This, however, might not have been the best use-case for the questionnaire as there are studies that show standardized UX questionnaires may not always be as useful as one might expect (Lallemand & Koenig, 2017). We still saw potential use for the data we might get from meCUE, especially as we wanted to have more of a broad understanding of the hedonic aspects of our prototype. We ended up excluding the second group of questions from the questionnaire, because that section was more related to the visual design of the prototype, and since we did the evaluation with medium-fidelity wireframes of the interactive prototype, asking design-related questions would not have been reasonable. We decided to leave other parts as such so that the results of those could still be analyzed properly. First, we also thought about using the SUS questionnaire, too, to get extensive feedback about the usability of our prototype, but we soon agreed that the meCUE questionnaire would give us enough information about that in this phase. Also, we didn't want to consume participants' time too much.

Even if the methods weren't perfect, we did get enough useful data in our results that we could easily adopt to improve our design.

Additionally, the meCUE questionnaire gave us useful data quite quickly from multiple people.

5.2 Results

The qualitative data gained from the evaluation was analyzed using an improvised feedback capture table, where the UX goals, usability issues, general feedback on the test tasks, prototype, and session were in columns. Each participant's comments/paraphrases were colour-coded. The table rows were used to further categorize the comments into likes, criticisms, questions, and ideas. The complete analysis is in Appendix I.

In our user study, all the participants reported higher (subjective) tech-savviness, whereas the ones who participated in the prototype evaluation had mainly quite limited technical skills. The evaluation revealed that those less tech-savvy people need a lot more help with navigating the system and understanding its logic. However, even the techier participants had problems locating the pages on the left bar, when they first scrolled down on the dashboard, for example. Additionally, nearly all the participants were unable to find the project dashboard, which is the most important page. They didn't understand that "Home" was the place they should look at.

Many of the results were heavily affected by the overall lack of usability and aesthetics, as our prototype is still in such early development. Many of the results, especially when assessing relief and security, were partly due to the design being too dull-looking or unpolished. These, however, gave us valuable information and appreciation of all the small details and options that different ERP applications or even messaging applications have built upon them to ensure ease of use.

The evaluation revealed that residents want to see reliable reviews and ratings that are based on actual projects done by the users of the BuildingHub. Ratings need to include multiple aspects of the project, like communication (within BuildingHub), quality of work, staying on schedule and budget, etc. Residents are interested in companies' offerings, prices, operating areas, specialty/expertise and when they could start the project. Contact details are needed, and reliable reference images of projects are valued, especially the ones taken and added by actual customers. The tax debt register information was also something that one participant specifically would look at to gain trust. Trust is a bit difficult UX goal to balance, as we tested the usefulness of identifying a user of the system via bank credentials, so that the reviews and ratings for companies would be from identified users to increase their trustworthiness. However, basically, all the participants hesitated with the e-identification, as the following comments from participants P3 and P4 reveal:

P3: *I have to identify (bank ID) and this sounds like this came too soon... It's kind of frightening me.*

P4: *I don't really want to put my bank account here.*

They didn't want to continue from there and give their bank credentials. Additionally, some of them stated, that it came too

early during the "exploration" phase of the system. Without e-identification, the question of having reliable people reviewing the contractors would, however, be even trickier. The participants also made it clear that they would like to be able to search for proper companies without having to sign up to the BuildingHub.

The participants expressed their need to synchronize the calendar within BuildingHub with their own calendars, like Outlook and Google Calendar. This would help them stay more informed. The participants also especially wanted to know what tasks, meetings, etc. would require their own attention, as well as to be able to see the whole content of things in the calendar, e.g. what's the meeting about, who will participate and what are their contact details. Another one was that there should be an even clearer way of knowing what messages and documents were new and what was old. Furthermore, the question of what metrics were used to determine the project progress or status arose, as in actual renovations projects, unexpected events are bound to happen. The current way of indicating project's overall status caused some participants more anxiety than relief, which wasn't our intention, of course. They felt that the status bar would likely move back and forth or even stay still nearly until the end of the project.

For the UX goals of relief and security, the overall theme of not having enough detailed information was clearly a problem. Both experiences suffered due to the lack of clear information within the calendar and what was needed from the user. Some sort of feedback system and a communication channel to at least show the user's emotions through emojis were something that became a noteworthy addition. The selected emoji also should be supported by an explanation. For the feeling of security, there arose the need for more information regarding the people who have access to the project files within BuildingHub with certain rights. Another was knowing who would be at the renovation site at a given time and any occupant notices, e.g., pets or kids at home.

Security and relief were the hardest UX goals to be evaluated because our prototype didn't focus that much on the latter part of the renovation, meaning the very last part of the during- and post-phases of the renovation, where they were mentioned in our experience journey map.

The results from the meCUE questionnaire (see Appendix J) revealed that the participants' opinions varied quite a lot in general. However, the overall score for the question "How do you experience the product as a whole?" was 2.9 on a scale from -5 to +5, so in that sense, the participants were quite happy with our concept. None of them gave any minus grade. The person (P3) who had experienced a lot of problems and communication issues during her renovation, gave the most positive feedback overall, whereas the one (P2), who would want to visit the construction site regularly and get things done preferably with a phone, gave the most negative answers, even though she still gave a grade 3 for the overall experience of the product. In summary, our BuildingHub product has received positive feedback from all participants, indicating that we are on the right track in addressing residents' pain

points related to building renovation. Some minor issues can be taken into consideration in the future to finalize the product based on user testing feedback.

Not all the improvement ideas we got from the evaluation could be included here. For a more detailed list of those, see Appendix K.

6. DISCUSSION

6.1 Main findings

Our resource constraints affected the overall results of the project, as we were probably not able to meet all the needs and expectations of the person working on the INPERSO project. Even though with the user study we tried to get insights on, for example, how to make renovation projects more community-driven, we couldn't answer this one. The main reason for this was the fact that our participants didn't have that much experience of renovations, and especially of big renovations like deep renovations. Sustainability-related aspects were also a big theme, but it became obvious, that in Finland that's usually not the thing people focus on the most in renovations, even though some are more environmentally conscious.

Even though we tried to lower the participants' expectations about the prototype, they still expected it to look better and more refined, meaning they hoped it would have had images, colors, etc. The lack of those affected their experience of the prototype, which may affect the validity of the results. Additionally, as Minge and Thüring (2018) state, the prototype should have enough visual aesthetics so that the test users can perceive it to be good and usable. We should have considered this more closely.

Of the UX goals, trust, and the feeling of being informed were the easiest ones to measure. Both relief and security heavily leaned upon the first two goals within this early prototype. As such, many possible problems did not really surface as the overall usability and experience were, in many ways, too lacking for the people testing it. Additionally, relief and security could have been measured better with a more defined prototype. Now the content of our prototype focused mainly on the before and during phases of the renovation, whereas based on our experience journey map, relief, and security (safety) were something that would be more needed in the latter part of the- and after- phases of the renovation. Similar to our findings regarding the need to know what is being used to determine the renovation project's progress, Konstantinou et al (2021) stated it was central to have a clear definition of the requirements and key performance indicators used to evaluate the project.

The biggest success of this project was the validation that this kind of service can be useful when implemented correctly, like the comments from one of the participants in the evaluation session reveal:

P3: It would've been just what I really really was missing when we had the renovation!

P3: This would be like really really something that would help, help people, and I really hope that companies are gonna commit using this if it's something that gets done.

Additionally, from very early on, we understood that it would be very useful to have a platform where the different stakeholders could have an easy way of communicating with each other. Many contractors use different kinds of ERP systems (or other internally used systems), but they never or very rarely give access to other stakeholders. This also creates the problem of having enough useful and accurate information that is still easy to understand and get a hold of. Experience-driven design helps to alleviate key problems that could easily be at the forefront if only the pragmatic side of these services were considered. The navigation should be very easy so that anyone can find what they are looking for. The other part is that the website should look more consumer-friendly and beautiful. This would help in the engagement of the users in the beginning.

6.2 Limitations

One of the biggest limitations for us was the lack of people with enough experience with renovation projects. We also had to cut all but one user group, the residents, out of the final prototype, because otherwise, the scope of the project would have been far too large for this course. This also diminished some of the data collected during different parts. We had the opportunity to interview an architect, but that information wasn't as useful when designing the website from the viewpoint of a resident having to be a part of a renovation project. Additionally, since we created the UX goals and prototype from the residents 'perspective, our results cannot be generalized. They cannot also be directly generalized to other countries because of cultural issues, for example.

The scope of this project was excessively large for this course even though we attempted to decrease it both before and during the project. It could have been more useful to concentrate just on the before and during phases of the renovation project, or first just on one of those. Additionally, due to the scope of the project and the course as well, another huge limitation of the validity was the lack of time. Even if we had a more fleshed-out prototype or even a running website, the information gathering for these goals could only be done properly in a large time frame study. The project that kickstarted ours, the INPERSO project, even mentioned that these would be inspected in three parts: before, during, and after the renovation project. This means that we could only get a small glimpse of what could be from the before and during the renovation phases. An additional meeting with our contact person from the INPERSO project could have been beneficial in the later phase of our project, even just to keep us on track more precisely. However, that would have again increased the number of our working hours.

The third major limitation was our own lack of knowledge of Finnish laws and renovation and house building business. To make an all-encompassing BuildingHub, a platform where everything useful for every stakeholder could be found, would be extremely difficult without a multi-professional team. Even designing a

website from only the residents' point of view proved to be harder than we initially thought.

Yet another major thing is, that our prototype relies on the so-called best scenario, meaning it doesn't consider any possible limitations related to the numerous software components that should be integrated with the system. Additionally, a lot is also relied on human behavior. It remains uncertain whether actual construction workers would willingly adopt this system, as, based on their own experiences, they generally do not put any extra effort into communication or using additional systems.

Lastly, language barriers affected the participants' understanding of some questions and instructions as well as navigating the system. If the prototype and sessions with the participants both in the user study and evaluation phase were in Finnish, the results might have been a lot more comprehensive and reliable. Additionally, the UX goals couldn't be evaluated properly especially due to lack of some important interactions. A more polished prototype with all the interactions needed to make it work the way it's supposed to, would most probably have given different kinds of results.

6.3 Future work

We gained a lot of development ideas for the prototype from its evaluation and already did some iterations for the prototype (see Appendix L). Based on the results from the evaluation, we decided to focus our iteration on the pages and elements that would help fulfill at least one of our user-experience goals, trust. To improve trust, especially in the before phase of the renovation, we made some changes to the company card, like including information about the working area, prices, and starting schedule, and made the reviews more comprehensive.

Regarding some usability issues, we decided to make the left navigation stay fixed, meaning they would always see its content even when scrolling down a lot. We renamed the "Home" to "Project dashboard" so that the users would more easily locate the most important page. Additionally, we added a help section to the design and guided them to this section from the empty project dashboard, where they first land after signing up.

Not all the ideas based on the user study and prototype evaluation could be implemented or even analyzed in the scope of this course. For example, integrations with different ERP software to make the use of BuildingHub more plausible for the contractors, and more detailed information about the contractors and their financial situation.

In the future, the project dashboard should show more clearly what tasks and meetings need residents' input, and a better timeline should be considered and designed carefully to increase the level of relief. Overall, the project dashboard should be made adjustable to everyone's needs, so that it would include the most relevant information needed.

Additionally, a feedback system should be implemented. It should be used both during and after the renovation, and the feedback form

would also need to include information about how well the company used BuildingHub for communication. In that, at least based on one participant's opinion, it would maybe engage the companies to use BuildingHub properly, as others would consider that aspect as well when deciding the company, they want to work with.

The prototype focused now mainly on the before and during phases of the renovation. In the future, it should also serve better in the after phase. Additionally, the prototype is now designed from the residents' perspective. In the future, it should also have to meet the needs of other stakeholders of building renovation projects, especially construction companies and their actual employees and subcontractors who do the renovations. To do this, more user studies, evaluation, and iteration would be needed, and experience goals for those parties would also need to be defined and validated, as they may also differ at least partly from the ones we had for residents. In addition, it should be carefully thought out how to engage companies to use BuildingHub.

To further develop the design, the evaluation tasks of the reiterated prototype about the UX goals would be formulated from prior or existing methods known to be relevant. In the future, a heuristic analysis based on Jacob Nielsen's 10 usability heuristics would also be useful for the prototype.

7. REFLECTION OF GROUP WORK

Our group work went nicely, and communication was not an issue, but ideally, we could have divided the work more properly, because in that way our total working hours would maybe not have exceeded that much. We could also have done a better job with user study questions. Less could have been enough. The biggest challenge was, however, lack of time combined with the scope of the project. All in all, we succeeded at getting useful data and designing an extensive prototype – or a wireframe of it – that can be designed and iterated further.

All our group members worked hard with this project. As we were a group of four, we were supposed to conduct two evaluation rounds for the prototype. However, in the middle of the project it became clear that one of our group members wasn't, due to personal reasons, able to contribute as much to the project as would have been needed in the later phase. Therefore, it was agreed with the teacher that only one evaluation phase is enough.

Each of us attended our weekly meetings, worked on the report, searched for articles, planned the user study, participated in it, and analyzed the data from it. Fareed and Tuire created the user persona and Tuire did the experience journey map. Quynh created the user flow. Arto was more in a project manager's role, and also communicated with the researcher from the INPERSO project.

Tuire, Quynh and Fareed were responsible for creating the prototype, and Tuire did some iteration to it after the evaluation. Tuire recruited 8 participants (3 for the user study and 5 for the evaluation), and Arto recruited one for the user study. Tuire was

present in all interviews, and Arto, Fareed and Quynh in some of those. Each member worked as a moderator at least once, and all of us also observed and took notes. Arto didn't participate in the evaluation. Fareed and Quynh also did the analysis of the data we got from the evaluation, and Tuire prepared the questionnaire and script for the evaluation.

Hours we put into this project were roughly as follows:

- Arto: 81
- Tuire: 157
- Fareed: 110
- Quynh: 115

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APPENDIX A. Interview questions for residents**1(2)****Background questions:**

1. Could you tell us about yourself (such as age, sex, occupation and location)?
2. How tech-savvy are you? (on a scale 1-5 + ask why)
3. Do you live in a rental or in an owned property?
 1. What is the apartment type and floor?
 2. How long have you lived in your current home?
 3. Who do you live with, if any?
4. How would you describe your relationship with your neighbours?
 1. How often do you interact with them and how?

General view/experience on renovation process:

1. What factors are most important to you when deciding to renovate your residence (e.g., energy efficiency, cost, aesthetics, comfort)?
2. What is your previous experience of renovation projects?
3. Can you describe your influence on renovation work within the building you have lived in / currently live in?

Communication & information sharing:

1. What parties/stakeholders (like construction workers, architect, housing co-operative etc.) were involved in the renovation project?
2. Could you describe the communication between different stakeholders (e.g. constructors, architect, housing cooperative) of the renovation project?
 1. What information was available for you before the start of the renovation project?
 2. How understandable was the information?
 3. How was all the information shared before, during and after the project?
 4. What kind of challenges did you face when communicating with different stakeholders?
 5. What kind of information was or would have been most important to you?
 6. What specific digital tools, platforms, or resources you think would be helpful in managing and communicating in renovations better?
3. What kind of opportunity to provide feedback or raise concerns did you have?
 1. How were they addressed?
4. What kind of schedule/timeline for the renovation did you get?
 1. How was it adhered to?
5. How were you (and/or other residents) involved in decision-making processes related to the renovation, such as design choices or scheduling?

Safety, security and cleanliness:

1. How did you feel about your safety or security during the renovation?
 1. What kind of safety measures were there to protect residents during the renovation (e.g., barriers, warning signs)?
2. How did you experience debris, dust, or other cleanliness related issues during the renovation?

2(2)**Disturbances/inconveniences - Noise and disruption, temporary movement:**

1. What arrangements did you have to make before and during the renovation (e.g. moving to another apartment)?
2. How did you cope with the noise and disruption?
 1. What actions were taken to minimize noise and disturbance to residents?

Experiences and feelings:

1. How would you describe your feelings in general before, during and after the renovation?
2. What kind of expectations did you have for the renovation project?
 1. How were they met?
3. What aspects of the renovation went well and why?
4. What were the main pain points or frustrations for you in the renovation project and why?
5. How can a renovation process be more convenient for residents?
6. How would an ideal renovation project be like?

Perception of energy consumption:

1. How would you describe yourself in terms of environmental awareness, e.g. energy saving?
2. How aware are you of your household's energy consumption?
 1. How do you reduce energy consumption in your household / what steps do you take?
 2. When purchasing new appliances, how much attention do you pay to their energy efficiency?
 3. What kind of barriers have you confronted in improving your household's energy efficiency?
 4. How do you utilise / how have you utilised technology in reducing your household's energy consumption?
3. How aware are you of your residential building's energy efficiency?
 1. What are your thoughts on improving energy efficiency of your home?

APPENDIX B. Interview questions for an architect**1(2)****Background questions:**

1. Could you tell us about yourself (such as age, sex, occupation and location)?
2. How tech-savvy are you (on a scale of 1–5, and why)?
3. What kind of experience do you have on working as an architect and/or studying architecture?

General view/experience on renovation process:

1. What factors are most important from your point of view as an architect when starting to work in a building renovation project (e.g., energy efficiency, cost, aesthetics, comfort, regulations)?
 1. How would you rank them?
2. Can you describe your role in the biggest/most recent (renovation) project where you've worked as an architect?

Communication & information sharing:

1. What stakeholders (e.g. constructors, architect, housing cooperative) were involved in the renovation project?
2. Could you describe the communication between different stakeholders of the project?
 1. What kind of challenges did you face when communicating with different stakeholders?
3. What information was available for you before, during and after the renovation project?
 1. What kind of information did other stakeholders request/ask from you?
 2. What kind of information did you request from the stakeholders?
 3. What information was most useful for the project?
4. What are the common challenges or pain points in coordinating renovation projects with residents?
 1. How about other stakeholders, like building contractors?
5. What tools or processes did you use to streamline the renovation process and communicate with clients?
6. What kind of digital solutions or platforms have you used in your renovation projects?
 1. Could you describe their pros and cons?
7. What improvements could be made to enhance collaboration and communication between for example contractors/architects and residents during renovations?
8. What specific digital tools, platforms, or features would be helpful in managing and communicating in renovations better?
 1. What features or functionalities would you like to see in digital tools or software that could assist with project management and client communication?
9. What kind of opportunity to provide feedback or raise concerns did you have?
 1. How were they addressed?
 2. How was the scheduled timeline adhered to? How did the communication affect the adherence of the schedule

2(2)**Energy efficiency:**

1. How do you take into account the building's energy efficiency in your proposals to clients?
 1. How do they perceive it?
2. What kind of barriers have you confronted in improving buildings' energy efficiency?
3. How do you ensure that the renovation designs align with the sustainability/energy-efficiency goals and preferences of your clients?

Regulations and other possible barriers:

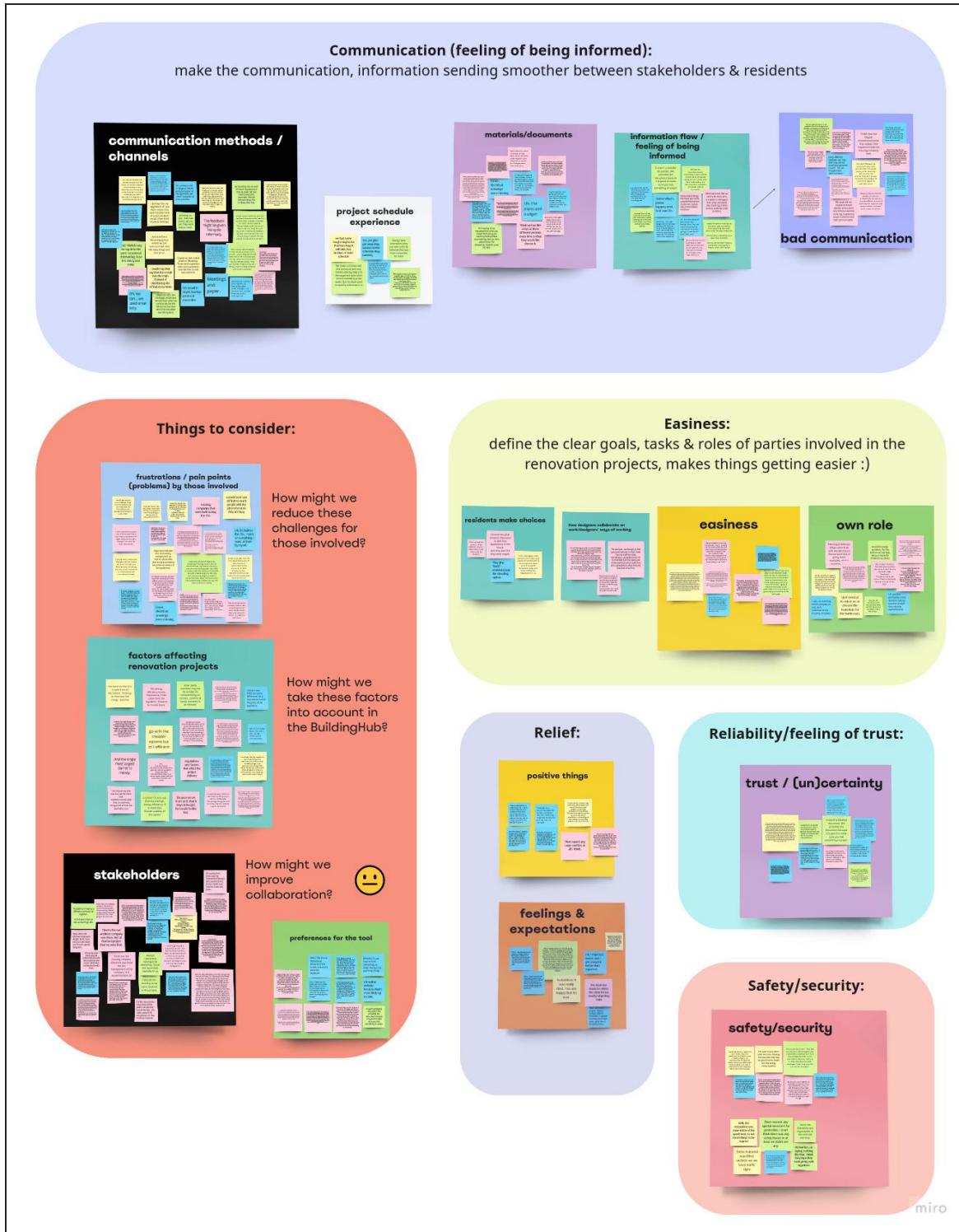
1. What issues related to permits, regulations, or approvals you find particularly challenging during renovations?
 1. How did these issues affect the project?

Experiences and feelings:

1. How would you describe your feelings before, during and after the renovation?
2. What kind of expectations did you have for the renovation project?
 1. How were they met?
3. What aspects of the renovation went well and why?
4. What were the main pain points or frustrations for you in the renovation project and why?
5. How can a renovation process be more convenient for an architect?
6. How would an ideal renovation project be like, from your point of view?

APPENDIX C. Affinity diagram of the user study

Link to affinity diagram: <https://miro.com/app/board/uXjVNGXDr5U=/>



APPENDIX D. User persona



Tero Kinnunen

Age: 38
Location: Tampere, Finland
Occupation: Senior Developer
Family: Wife + 2 kids

"Renovation projects are always expensive and I expect to get good value for my money."

Bio

Tero is a Senior Developer with an extensive background of 15 years working in the field. He bought an apartment with his family from an old row house a while ago and also got selected to the management of the housing cooperative. He's planning to renovate the apartment extensively to match it better with his family's needs and preferences.

Needs and expectations

- Get a reliable construction company to handle the renovation project
- Good quality of work
- Proper communication between all the parties involved in the renovation project
- The project to stay in budget and in schedule
- Affordable renovation project

Goals and motivation

- Comfortable living for his family in a healthy and nice looking home
- Affordable project

Frustrations and pain points

- Carefree attitude to work and bad quality
- Unwanted surprises, especially those that delay work completion or cause extra costs
- Threats to family's safety/security
- Hates to use mobile phone for larger and complex tasks

Personality

Organised Introvert
Calm Techy



APPENDIX E. Experience journey map

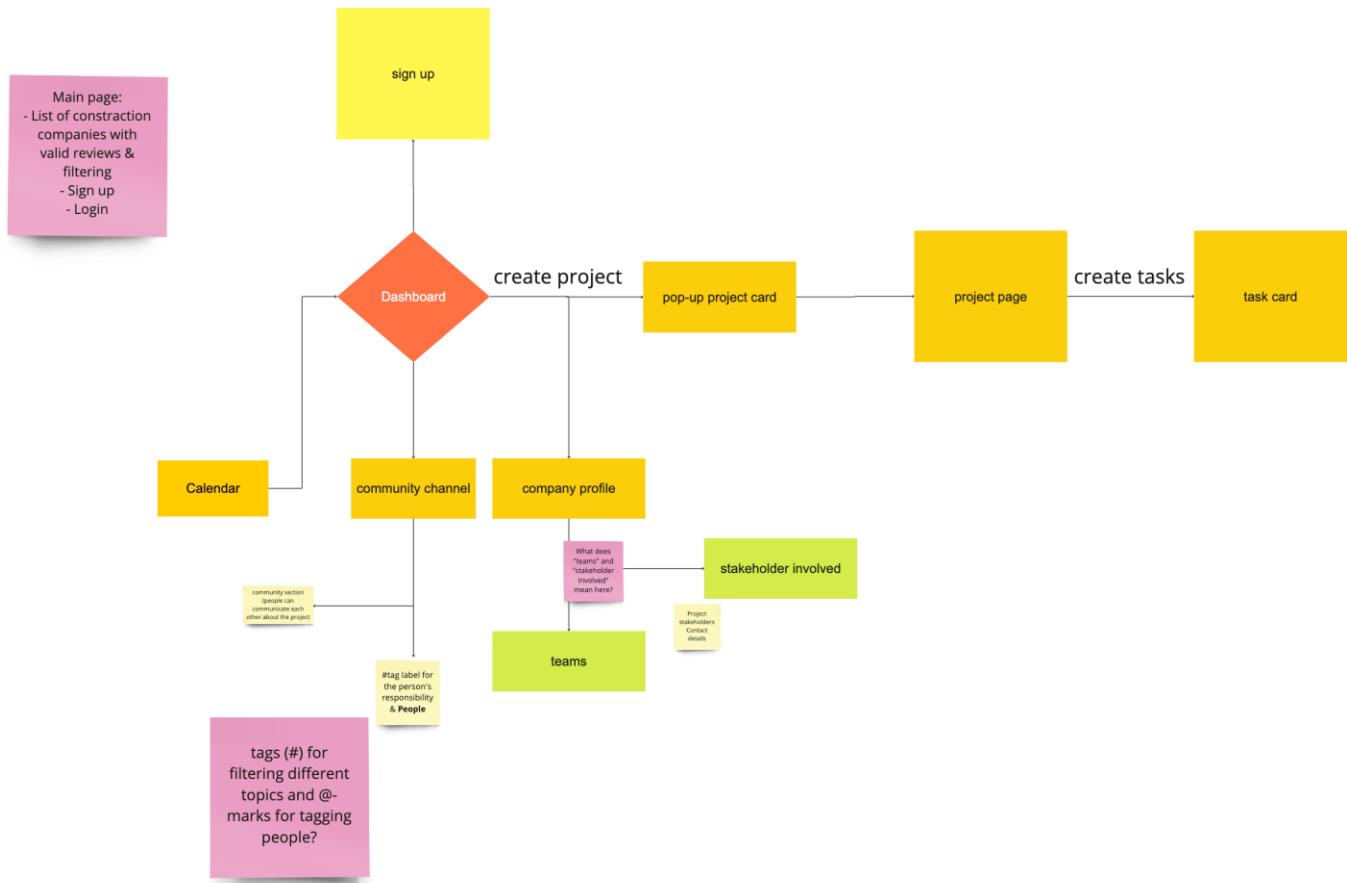
Link to the experience journey map: <https://miro.com/app/board/uXjVNGXDr5U=/>

STAGE	BEFORE							DURING					AFTER				
Journey Steps Which step of the experience are you describing?	Research & planning What needs to be renovated; what is the goal, budget and schedule; who are trustworthy contractors							Getting and comparing offers & making contracts					Working with the stakeholders The beginning of the renovation				
Actions What does the person do? What information do they look for? What is their context?	Plan the renovation	Benchmark others (what have others done, how and with whom)	Find reliable contractors	Provide all the necessary information to the superintendent for getting offers	Ask the superintendent to provide options for the possible contractors	Select the contractor(s) and agree on the project	Give the contractor(s) access to the site	Visit the work site to see the progress	Take pictures of the progress for documentation	Informally (just the contractor) when initial work has been done what is being done	Have a final meeting with the contractors	Retrieve keys from contractors	After the renovation work Pay the final bill after everything is completed				
Thinking	Will the renovation go as planned? How do I get reliable & competent contractors?	What is everything going to cost? And how long is it going to take?	Will the renovation stay on schedule and on budget?	Will me supervisor be able to provide me with the necessary information for getting offers?	How can I compare all these offers because they are so different?	Will the house be a safe and healthy place to live during and after the project?	How to get things started so that everything is ok.	What and where are the contact details?	I have already signed the contract, what's next?	How's everything going? Any problems?	Why didn't the contractor inform about this issue?	I wish I was needed less	I want to be informed about any delays / safety issues	Not going to do another renovation or a long time	It's finally over and my house is a safe & healthy place to live now	We were able to make this happen!	
Customer Feeling What is the customer feeling? Tip: Use the emoji app to express more emotions	Concern 😰 Uncertainty Concern	Concern 😰 Uncertainty Confusion 🤔 🤔	Excitement 😃 😃 Concern 😰	Frustration Exhaustion Tiredness	Relief Safety	Happiness											
Needs and Pains What does the customer want to achieve or avoid? Tip: Reduce ambiguity, e.g. by using the first person narrator.	I want to find reliable contractors and workers	I don't want to go over my budget	I want the renovation to fit my needs and finish on time	I want a nice result and my house to be a safe place to live	I don't want to end up choosing bad contractor	I need the superintendent to provide me with the necessary information for getting offers	I want to be able to compare the offers easily	I want to know what will be done. When exactly?	I need to have a clear contact and the necessary information to start working on now	I expect quality work and that the contractor stays within the budget	I need to know what just of the project is done	I wonder if the renovation will finish on time	I need to know if there are any problems	I expect that the renovation is done with high quality	I need the renovation to be a safe place to live in	I need to get the key back from the contractor	I want to warn other about the contractor if I want to praise the contractor
Opportunities What could we Improve or introduce?	What should be renovated and in what order to keep the building in a good shape?	Trustful reference of contractors	Learn from previous experiences (neighbours and others)	Details of contractors to be contacted	Offers that are easy to compare and choose from	Better communication between the customer and the supervisor	Comprehensive agreements ('checklist service')	Building plan, electricity cabling plan	Information of the project and necessary tools and materials when and what to do	Proper and easy documentation of the project bank	Notifications of upcoming tasks and work hours/times	Reduce the need of being in the project	Proper communication channels, not just emails	Milestone of work done (incl. photos)	Safety measures for workers & other neighbours	Feedback for the renovation for also others to use in the future	
Experience Goals	Feeling of trust		Feeling of trust			Easiness			Feeling of being informed			Feeling of being informed		Safety		Relief (incl. completion) Safety	

miro

APPENDIX F. User flow

Link to the user flow: <https://miro.com/app/board/uXjVNGXDr5U=/>



APPENDIX G. Initial prototype/wireframes

Link to the initial prototype: <https://tinyurl.com/buildinghub> (open the Flows sidebar and select “Initial prototype”)

The wireframe illustrates the initial prototype of the BuildingHub platform, structured into several main sections:

- Header:** Features the BuildingHub logo, navigation links for "FAQ", "Login", and "Sign up", and a search bar.
- Hero Section:** Headlined "Smoother renovation projects from start to finish", describing BuildingHub as a central platform for renovation projects. It includes a call-to-action button "Sign up to get your renovation project flow smoothly".
- Testimonial Section:** A large box containing three user reviews, each with a star rating and a profile picture. The reviews are:
 - Marko Laajala, Tampere:** "Thanks to BuildingHub my renovation project went really smoothly! I could find a reliable construction company and everyone was on the same page during the project."
 - Tytti Hiltunen, Seinäjoki:** "Thanks to BuildingHub my renovation project went really smoothly! I could find a reliable construction company and everyone was on the same page during the project."
 - Matti Murto, Renomatic Oy:** "BuildingHub keeps all the parties informed in the renovation project. It has reduced the amount of phone calls and emails from the customers and sub contractors dramatically."
- Video Callout:** An overlaid video player showing a play button, with the text "Watch a short video of how the BuildingHub works".
- Call-to-Action:** A prominent "Sign up to find reliable partners and get the project started!" button.
- Footer:** Contains the BuildingHub logo, a promise to create a transparent community, and links for "About BuildingHub", "FAQ", "Login", and "Sign-up".

e-Identification

You are identifying yourself to the service

SUOMI.FI

Select identification method

			
Certificate card	Mobile certificate	OP Bank Group	Nordea
	Handelsbanken	ÅLANDSBANKEN	
Danske Bank	Handelsbanken	Ålandsbanken	S-Pankki
Aktia			
Aktia	POP Pankki	Säästöpankki	Oma Säästöpankki

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Suomi.fi e-Identification is a shared identification service for public administration e-services. It will make identification secure and easy. You can use the identification method of your preference. Suomi.fi e-Identification uses a brokering service. The brokering service for OP Identity Service is provided by OP Group banks and OP Corporate Bank. At the time of identification, the user's personal identity code and name are transmitted to the service provider. [Privacy notice](#)

[Information about Suomi.fi e-Identification](#) [Data protection](#) [Accessibility](#) [Cookie information](#) [Report an error](#)

A verification email has been sent to the email address you provided.
Add the 5-digit code from the email to the field below to verify and
finalise your sign-up.

12345

VERIFY

BuildingHub

FAQ Login **Sign up**

[Sign up as a resident](#) [Sign up as a company or housing co-operative](#)

Sign up as a resident

Information provided by the e-Identification

Name: Mikko Mallikas
Social security number: 230185-234D

Telephone *
0401234567

Email *
your.email@address.com

Street address *
Makkarakuja 1 A 7

Postal code *
12345

City *
Tampere

Password *
At least 8 characters that include both letters, numbers and special marks

Verify password *

SIGN-UP

BuildingHub

At BuildingHub, we promise to create a transparent community for all parties, ranging from collaborated companies to residents.

Find a reliable professional and start working to create the better home-life without any challenges.

About BuildingHub
FAQ
Login
Sign-up

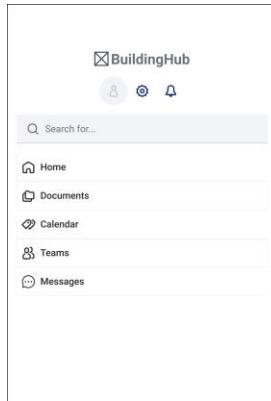
The screenshot shows a user interface for a project management application named "BuildingHub".

Left Sidebar:

- Logo: BuildingHub
- User icon: Profile picture placeholder
- Search bar: Search for...
- Navigation menu:
 - Home
 - Documents
 - Calendar
 - Teams
 - Messages

Right Main Area:

- Greeting: Good morning, Mikko!
- Project search bar: Project: All
- Project filtering: Start date and End date fields with calendar icons.
- Message: You don't have any projects yet. Please add a new one or start by finding a professional to work with.

The sidebar on the left contains links for Home, Documents, Calendar, Teams, and Messages. A search bar at the top says "Search for...".

The main page has a header with a back arrow, a search bar labeled "Find a professional", and a button "+ New project".

Find a reliable professional for your renovation project

Search by name 

Offering - Location - Reviews - Company size - Sort by: Reviews 

Bathroom X Pirkkala X 5-10 employees X Clear All


Renomatic Oy ***
#renovation #kitchen #bathroom
Short description of the company and what it offers

★★★★★
+ Ask for a quote


Renova Oy ***
#kitchen #bathroom #painting #wallpapering
Short description of the company and what it offers

★★★★★
+ Ask for a quote


Company Oy ***
#kitchen #bathroom
Short description of the company and what it offers

★★★★★
+ Ask for a quote


CompanyA Oy ***
#kitchen #bathroom
Short description of the company and what it offers

★★★★★
+ Ask for a quote


CompanyB Oy ***
#kitchen #bathroom
Short description of the company and what it offers

★★★★★
+ Ask for a quote


CompanyC Oy ***
#kitchen #bathroom
Short description of the company and what it offers

★★★★★
+ Ask for a quote


CompanyD Oy ***
#kitchen #bathroom
Short description of the company and what it offers

★★★★★
+ Ask for a quote


CompanyE Oy ***
#kitchen #bathroom
Short description of the company and what it offers

★★★★★
+ Ask for a quote


CompanyF Oy ***
#kitchen #bathroom
Short description of the company and what it offers

★★★★★
+ Ask for a quote

Bathroom

Electricity

Kitchen

Painting and wallpapering

Plumbing

LOGO Renomatic Oy
★★★★★
[Ask for a quote](#)

Company details
Offering

VAT Number: 1234567-8
Company size: 1-10
Established: 23.4.2011
Employer register: In register
Prepayment register: In register
Registered office: Tampere

Post address: Viistokatu 1, 33100 Tampere
Visit address: Viistokatu 1, 33100 Tampere

Contact person: Matti Murtto
Email: info@renomatic.fi
Phone number: 040 123 4567
Website: www.renomatic.fi

Financial figures
Revenue (million euros)
Profit or loss for the financial year (thousand euros)

Financial Year	Revenue (million euros)
2019/12	0.75
2020/12	1.5
2021/12	2.2
2022/12	2.2

Financial Year	Profit or loss (thousand euros)
2019/12	20
2020/12	50
2021/12	290
2022/12	350

★★★★★
★★★★★
★★★★★

I was really pleased with the quality of the work! Thank you so much for renovating our house just as we agreed. Everything went super smoothly.
I was really pleased with the quality of the work! Thank you so much for renovating our house just as we agreed. Everything went super smoothly.
I was really pleased with the quality of the work! Thank you so much for renovating our house just as we agreed. Everything went super smoothly.

Marko Laajala, Tampere
 Marko Laajala, Tampere

Reference images

BuildingHub

Search for...

Home Documents Calendar Teams Messages

← Back Find a professional + New project

Good morning, Mikko!

Project: Bathroom renovation

Overview Tasks 10 Documents 10 Team 3+ ... Start date End date

Project process status

Achieved Remaining

67%

Resident's mood during the project

Average mood 😊

Latest mood Electricity work (in progress) 😐

Demolition work (completed) 😊

Drainage (completed) 😊

[View all mood information](#)

Calendar

TODAY (22/11/2023)

Meeting with the building contractor 8:00 - 8:30 AM See detail

Moisture insulation 11:00 AM - 13:00 PM See detail

Messages View all

5 Unread messages

Jane Doe Site Supervisor Hi, I will start the checking week tomorrow at 14:00 to 15:00

Jane Doe Site Supervisor The new price for water pipe has been updated within 2 weeks

PROJECT TASKS:

+ New Task

TO DO	IN PROGRESS	COMPLETED
Moisture insulation Renomatic Oy Description Top 	Electricity work Renomatic Oy Description Top 	Demolition work Renomatic Oy Description Top
Tiling Company Description Top 		Drainage Company Description Top

Project:	Kitchen renovation
Project:	All

BuildingHub

← Back

Find a professional + New project

Good morning, Mikko!

Project: All

Overview Tasks 7 Documents 2 Team 99+ ... Start date End date

Project status

Achieved Remaining

67%

Project Mood

2/3 of ongoing projects feels:

Satisfying based on resident

View all mood information

Calendar

TODAY (22/11/2023)

Bathroom renovation: Meeting with the building contractor 8:00 - 8:30 AM See detail

Kitchen renovation: Installing of the cabinets 9:00 - 11:00 See details

Bathroom renovation: Moisture insulation 11:00 AM - 13:00 PM See detail

Newest message

5 Unread messages

Jane Doe Senior Designer Hi, I will start the checking week tomorrow at 14:00 to 15:00

Jane Doe Senior Designer Hi, I will start the checking week tomorrow at 14:00 to 15:00

Project:

Please fill in this form to create a new project:

Project name: Bathroom renovation Start date Approximate end date

Company collaboration: Renomatic Oy

Description
The bathroom is in its original shape (built in 1995) and needs to be renovated. The project will be finished in about 3 weeks. A turnkey project. More information will be updated constantly.

Documents

Task:

Please fill in this form to create a new task:

Task name: Fill information here

Status task: To do

Team: Eetu (Plumber) Niko (Site manager)

Don't know yet? Contact the company for more information.

Description
Write here short information about the new task.

Project images:

Task:

Task name: Drainage 22.11.2023

Status task: Completed

Team: Eetu (Plumber) Niko (Site manager)

Don't know yet? Contact the company for more information.

Description

Changing the old drainage to meet today's quality needs.
More information will be updated constantly

Project images:

Upload file Choose file

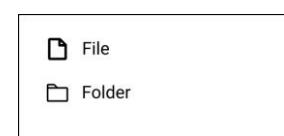
Delete Edit task

The screenshot shows a digital workspace interface. On the left, there's a sidebar with icons for Home, Documents, Calendar, Teams, and Messages. The main area is titled 'Documents' and shows a list of files under a 'Recent activity' section. The files listed are:

Name	Modified	Modified by	File Size	Sharing	Activity
Building plans	Nov 18	Jane Doe	6 items	Shared	You mentioned Jane Doe
Site photos pers	Nov 22	Mikko Mallikas	20 items	Private	
Invoice-567	Oct 10	Mikko Mallikas	200KB	Private	
contract for co-op company	Oct 10	Mikko Mallikas	200KB	Shared	
Doc1	Nov 22	John Doe	10KB	Private	
KeyAccess	Oct 10	Teemu Kannu	132KB	Shared, Protected	
Image001	Oct 10	Tero Mäki	2MB	Shared	
Video001	Oct 10	John Doe	160MB	Shared	

This screenshot shows a 'Manage Access' dialog for a file named 'contract for co-op company.pdf'. The dialog includes a 'Share' button and a 'Stop sharing' button. It lists three people with their roles:

- Mikko Mallikas (Owner)
- John Doe (Can edit)
- Jane Doe (Can view)



BuildingHub

Back Find a professional + New project

Calendar

Project: Bathroom renovation

Create Day Week Month Filter Share Print

Today < November 20 - 26, 2023 > Week 47

	Monday 20	Tuesday 21	Wednesday 22	Thursday 23	Friday 24	Saturday 25	Sunday 26
6:00 AM							
7:00 AM							
8:00 AM			Bathroom renovation Meeting with Building contractor 08:00 AM - 08:30 AM		Bathroom renovation Quick meeting with KK Housing Co-op Superint...		
9:00 AM							
10:00 AM							
11:00 AM			Bathroom renovation Moisture insulation 11:00 AM - 13:00 PM				
12:00 PM							

BuildingHub

Back Find a professional + New project

Calendar

Project: All

Create Day Week Month Filter Share Print

Today < November 20 - 26, 2023 >

Week 47

	Monday 20	Tuesday 21	Wednesday 22	Thursday 23	Friday 24	Saturday 25	Sunday 26
6:00 AM							
7:00 AM							
8:00 AM			Bathroom renovation Meeting with Building contractor 8:00 - 8:30 AM		Kitchen renovation Installing the flooring 08:00 AM - 09:00 AM		
9:00 AM			Kitchen renovation Installing of the cabinets 9:00 - 11:00...				
10:00 AM							
11:00 AM			Bathroom renovation Moisture insulation 11:00 AM - 1:00 PM				
12:00 PM							

Project:	Bathroom renovation
Project:	Kitchen renovation

The screenshot shows the BuildingHub interface for a project team. On the left is a sidebar with navigation links: Home, Documents, Calendar, Teams (selected), and Messages. The main area is titled "Project Team" and shows a list of team members for the "Bathroom renovation" project. Each member is represented by a circular profile icon and a card with their name, role, and company. The team members listed are Mikko Mallikas (Project Owner Resident, Renomatic Oy), Jane Doe (Site Supervisor, Renomatic Oy), John Doe (KK Housing Co-op Superintendent, KK Housing Co-op), Teemu Kannu (Architect, Talo Oy), Niko Ollila (Site Manager, Renomatic Oy), Kimmo Jussila (Kitchen Fixers Supervisor, Renomatic Oy), and Tero Mäki (Plumber, Renomatic Oy). Action buttons for each member include email, phone, and message icons.

This is a detailed view of the profile card for Jane Doe. It includes her circular profile icon, her name in bold, her title "Site Supervisor", and her company "Renomatic Oy". Below this, there are four contact options: Email (john doe@renomatic.fi), Call (+358 41 123 4500), Chat (john doe@renomatic.fi), and Project Role (Site Supervisor). Additionally, her company information (Renomatic Oy) and location (Tampere, Finland) are listed.

The screenshot shows a messaging interface within a software application. On the left, there's a sidebar with navigation links: Home, Documents, Calendar, Teams, and Messages. The 'Messages' link is highlighted. At the top right, there are buttons for 'Find a professional' and '+ New project'. The main area is titled 'Messages' and shows a list of unread messages. A dropdown menu indicates the 'Project' is 'Bathroom renovation'. The message list includes:

- Niko Ollila: Hi, I will start the checking week to... (12:00PM)
- John Doe: Hi, I will start the checking week to... (12:00PM)
- Tero Mäki: Hi, I will start the checking week to... (12:00PM)
- Jane Doe: Hi, I will start the checking week to... (20/11)
- Teemu Kannu: Hi, I will start the checking week to... (20/11)
- Kimmo Jussila and Tero Mäki: Hi, I will start the checking week to... (20/11)
- Jane Doe: Hi, I will start the checking week to... (20/11)
- Jane Doe: Hi, I will start the checking week to... (14 Nov 2022)

On the right side, a conversation with 'Jane Doe' is shown. The messages are:

- Jane Doe (Site Supervisor, Renomatic Oy): Yesterday 9:23: lorem ipsum lorem ipsum
- Jane Doe: Yesterday 9:50: lorem ipsum lorem ipsum
- Jane Doe: Yesterday 18:00: lorem
- Jane Doe: Yesterday 18:20: Video/Image file here
- Jane Doe: Yesterday 20:00: Audio file here

At the bottom right is a message input field with a smiley face icon, a paperclip icon, and a 'Send' button.

BuildingHub

Back Sign out

My profile

Mikko Mallikas ● Resident Tampere, Finland

Personal information

First name: Mikko
Last name: Mallikas
Email address: mikko.mallikas@outlook.fi
Telephone: 09577756621

Address

City: Tampere, Finland
Address: Koskikatu 23A
Post code: 33120

Projects

Bathroom renovation
Kitchen renovation

APPENDIX H. Script for the prototype evaluation**1(2)****[NOTE! To save some space, the more defined content is removed from here]**

- General info
- Introduction to the topic
- Instructions
- Recording consent and data handling
 - o Consent form (<https://forms.office.com/e/P4PwiCuG9c>) was sent also before the evaluation session via email

BACKGROUND QUESTIONS

- Could you tell me your age and sex?
- How tech-savvy would you describe yourself on a scale 1-5?
- What's your occupation?
- What's your experience of renovations?

TASKS

Prototype link: <https://www.figma.com/proto/54YU82HEN1ZYTxEPh5jk9A/No-name-squad?page-id=0%3A1&type=design&node-id=51-1218&viewport=1246%2C372%2C0.12&t=79ICtwE02BDU23Dh-1&scaling=scale-down-width&starting-point-node-id=51%3A1218&mode=design>

[Tries to measure especially trust]

Task 1: You just bought a row house apartment and want to renovate its bathroom. Use BuildingHub to find a reliable construction company to work with.

- A brief discussion

[Tries to measure especially relief]

Task 2: Let's assume that you have already created a new project in the BuildingHub for your renovation. Take a look at how your renovation project is progressing.

- A brief discussion

[Tries to measure especially the feeling of being informed]

Task 3: Could you tell me what's going on in your bathroom renovation project during the following days? Let's assume that today is Wednesday 22nd November.

A brief discussion

[Tries to measure especially security]

Task 4: Could you tell me who has access to the document named "**contract for the co-op company**"?

A brief discussion

MECUE QUESTIONNAIRE

<https://forms.office.com/e/UNUaEJQ9LL>

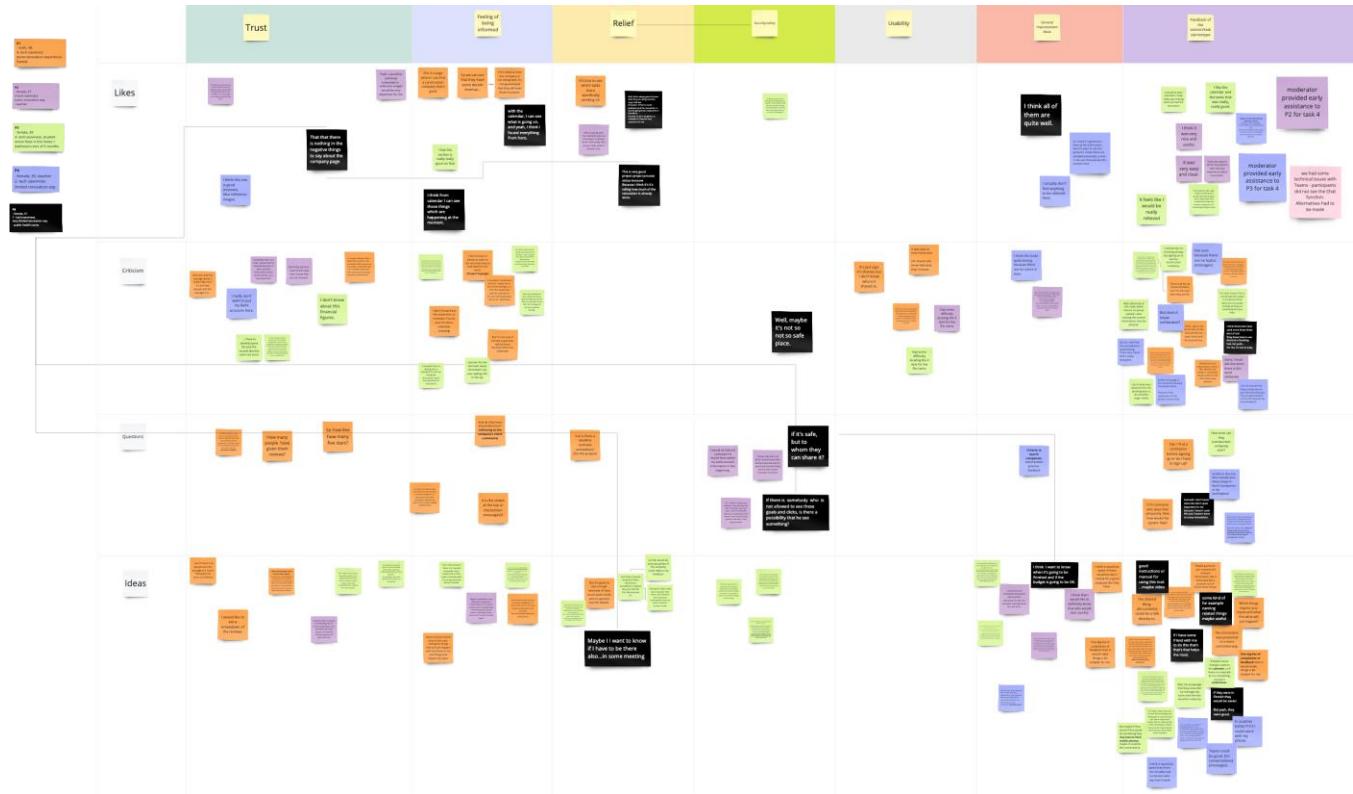
2(2)**POST-INTERVIEW (OVERALL DISCUSSION)**

[The aim is to get a better idea of the fulfilment of our UX goals and also get more information about improvement ideas]

- Our user study revealed that residents often have a need for feeling of being informed, trust, relief and security/safety in different phases of the renovation project (before, during and after).
 - How do you think these needs were met with the prototype? Why?
 - What kind of improvements could be made in order to accomplish these user experience goals better? Why?
- What kind of improvements/features would be most useful for you? Why?
- What do you think was out of place or not understandable in the system?
- How did you feel about the tasks and evaluation session in general?

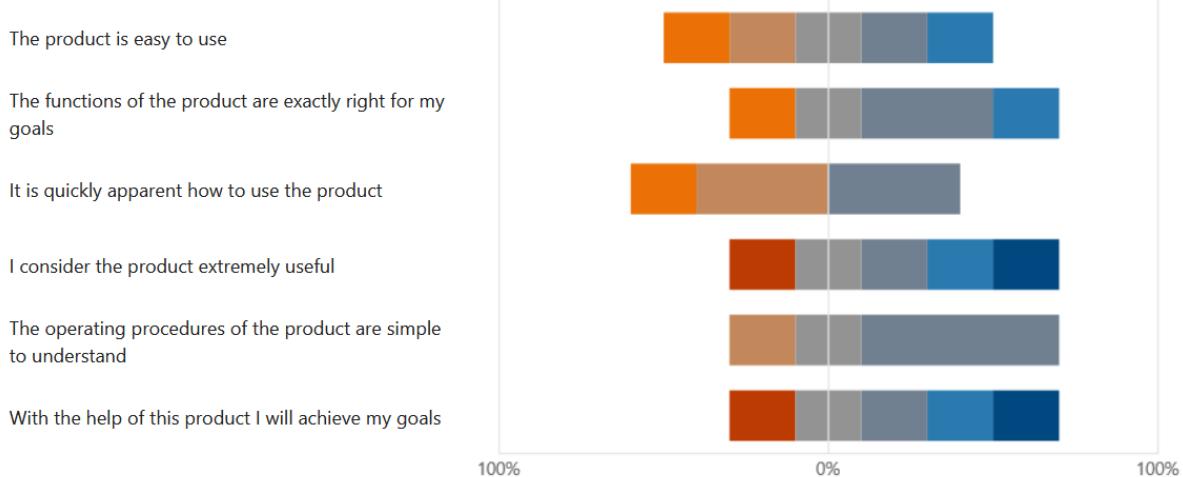
APPENDIX I. Results from the evaluation (qualitative)

Link to the analysis: <https://miro.com/app/board/uXjVNGXDr5U=/>

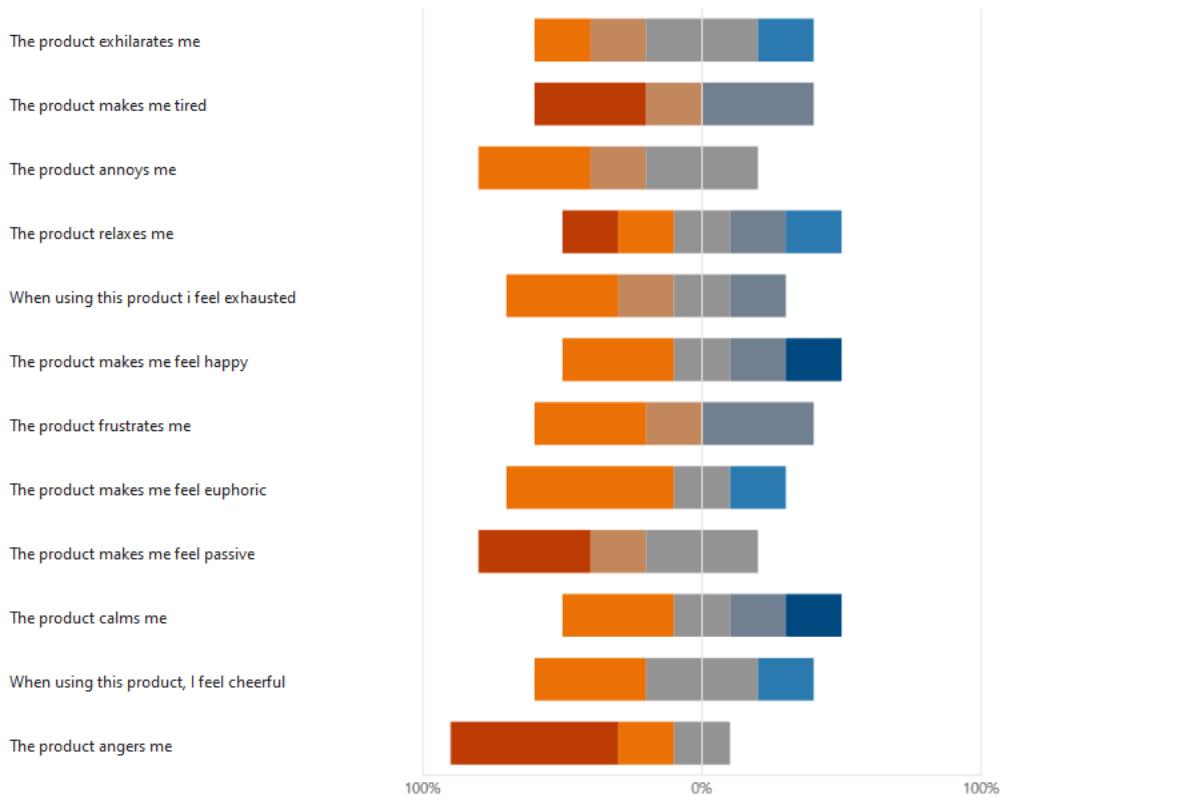


APPENDIX J. Results from the MeCUE questionnaire (quantitative)

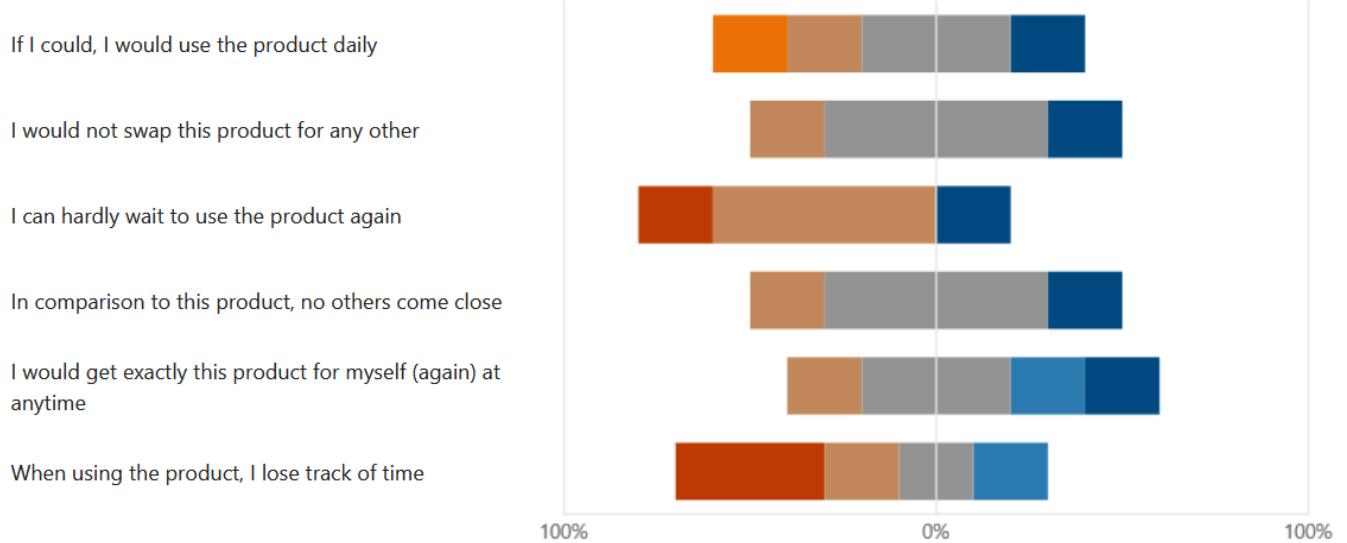
■ Strongly disagree ■ Disagree ■ Somewhat disagree ■ Neither agree nor disagree ■ Somewhat agree ■ Agree
■ Strongly agree



■ Strongly disagree ■ Disagree ■ Somewhat disagree ■ Neither agree nor disagree ■ Somewhat agree ■ Agree
■ Strongly agree



■ Strongly disagree ■ Disagree ■ Somewhat disagree ■ Neither agree nor disagree ■ Somewhat agree ■ Agree
 ■ Strongly agree



4. How do you experience the product as a whole? (Give any number between -5 and 5)

5 Results

ID ↑	Name	Answer
1	anonymous	4
2	anonymous	3
3	anonymous	+4,5
4	anonymous	0
5	anonymous	3

APPENDIX K. Improvement ideas gathered from the prototype evaluation

Experience goals	Improvement ideas from participant summary
Trust	<ul style="list-style-type: none"> • A breakdown of the reviews about the company by categories • Authenticity in profiles of the company, including real names, pictures, and contact details for relevance. • 5 criteria to assess company's competency • Visibility into price estimate • Past projects • Company expertise e.g a particular floor type • Use of real photos - projects, employees
Feeling of being informed	<ul style="list-style-type: none"> • More details in the calendar - who's involved • Make it visible what requires the resident's attention/input vs other users in tasks and calendar. • Project milestone • Have tasks by construction workers/professionals • Project works/schedule should be added by those doing the work e.g. supervisor information on scheduled start and end times should be present
Relief	<ul style="list-style-type: none"> • Make known what action/activities the resident is needed for • Milestone for the project • Give residents the possibility to explain why they feel a particular way (ref. project mood emoji) • Feedback system to report issues
Security/safety	<ul style="list-style-type: none"> • Know who's assigned to visit the resident's apartment (assigned persons) • Inform construction worker if the apartment is unavailable for visit e.g. pets in, who's currently in the apartment (like a caveat or caution)
General	<ul style="list-style-type: none"> • Visible the phone number of the person who are main in charge of the project, so user can easily contact • Better visual interface (user was tested with low-fidelity prototype) • More information about when the project is started • Instruction video about how to use the tool also very benefit • More information about price/cost, for example how much it cost per hour

miro

APPENDIX L. Iterated frames of the prototype

Link to the iterated prototype: <https://tinyurl.com/buildinghub> (open the Flows sidebar and select “Iterated prototype”)

Verify your sign-up

A verification code was sent to the phone number you provided. Add the 5-digit code from the message to the field below to verify and finalise your sign-up.

12345

VERIFY

BuildingHub FAQ Login [Sign up](#)

[Sign up as a resident](#) [Sign up as a company or housing co-operative](#)

Sign up as a resident

First name

Last name

Telephone *

Email *

Street address *

Postal code *

City *

Password *
At least 8 characters that include both letters, numbers and special marks

Verify password *

[SIGN-UP](#)

BuildingHub

At BuildingHub, we promise to create a transparent community for all parties, ranging from collaborated companies to residents.

Find a reliable professional and start working to create the better home-life without any challenges.

About BuildingHub
[FAQ](#)
[Login](#)
[Sign-up](#)

The screenshot shows the BuildingHub Project dashboard interface. On the left, there's a sidebar with a search bar and links for Project dashboard, Documents, Calendar, Teams, and Messages. The main area features a "Good morning, Mikko!" greeting and a "Where to start?" section. It includes a dropdown for selecting a project (set to "All"), navigation tabs (Overview, Tasks, Documents, Team, etc.), and date filters for Start date and End date. Top right buttons include "Find a professional", "+ New project", and a help icon.

BuildingHub

Project dashboard

Documents

Calendar

Teams

Messages

Search for...

Good morning, Mikko!

Project:

All

Overview Tasks Documents Team ***

Start date End date

Find a professional + New project ?

Where to start?

You don't have any projects yet. Please [add a new one](#) or start by [finding a professional](#) to work with.

You can also [view the instructions](#).

BuildingHub

Project dashboard Documents Calendar Teams Messages

Search for...

Find a professional + New project ?

Instructions on how to use BuildingHub

Search by keyword or phrase... 

Topic: All instructions 

1. Where to start?
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras id mi in mi dignissim mollis sit amet ac sem. Ut varius, tortor ac dictum placerat, nisl nunc aliquet dolor, non aliquet massa quam sed neque. Nam vulputate sapien enim, in euismod tellus ullamcorper ac. Nunc in sodales tortor. Sed vel augue viverra felis viverra consectetur. Etiam interdum finibus posuere.

2. Finding a reliable company to work with
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras id mi in mi dignissim mollis sit amet ac sem. Ut varius, tortor ac dictum placerat, nisl nunc aliquet dolor, non aliquet massa quam sed neque. Nam vulputate sapien enim, in euismod tellus ullamcorper ac. Nunc in sodales tortor. Sed vel augue viverra felis viverra consectetur. Etiam interdum finibus posuere.

3. Creating a project
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras id mi in mi dignissim mollis sit amet ac sem. Ut varius, tortor ac dictum placerat, nisl nunc aliquet dolor, non aliquet massa quam sed neque. Nam vulputate sapien enim, in euismod tellus ullamcorper ac. Nunc in sodales tortor. Sed vel augue viverra felis viverra consectetur. Etiam interdum finibus posuere.

4. Viewing and managing project dashboard
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras id mi in mi dignissim mollis sit amet ac sem. Ut varius, tortor ac dictum placerat, nisl nunc aliquet dolor, non aliquet massa quam sed neque. Nam vulputate sapien enim, in euismod tellus ullamcorper ac. Nunc in sodales tortor. Sed vel augue viverra felis viverra consectetur. Etiam interdum finibus posuere.

5. Communicating with different parties
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras id mi in mi dignissim mollis sit amet ac sem. Ut varius, tortor ac dictum placerat, nisl nunc aliquet dolor, non aliquet massa quam sed neque. Nam vulputate sapien enim, in euismod tellus ullamcorper ac. Nunc in sodales tortor. Sed vel augue viverra felis viverra consectetur. Etiam interdum finibus posuere.

X

LOGO Renomatic Oy ★★★★★ (See all 5 reviews)

Offering

Sauna Bathroom Kitchen Flooring Painting and wallpapering Electrician Plumber

Company details

Contact person:	Matti Murto	VAT Number:	1234567-8
Email:	info@renomatic.fi	Company size:	1-10
Phone number:	040 123 4567	Established:	23.4.2011
Website:	www.renomatic.fi	Employer register:	In register
Post address:	Viistokatu 1, 33100 Tampere	Prepayment register:	In register
Visit address:	Viistokatu 1, 33100 Tampere	Registered office:	Tampere

Your go-to partner for comprehensive renovation solutions in Pirkanmaa

Operating area

Pirkanmaa

Pricing

- Time or contract based billing
 - Construction workers 65 €/h
 - Electrician 55 €/h
 - Plumber 55 €/h

Schedule

- We can usually start within 2-3 weeks.

Matti Murto, owner of Renomatic Oy

Reviews from users of the BuildingHub ★★★★★ (See all 5 reviews)

★★★★★

I was really pleased with the quality of the work! Thank you so much for renovating our house just as we agreed. Everything went super smoothly.

Marko Laajala, Tampere

★★★★★

Excellent work with a decent price! The company kept us up-to-date of the state of the project via BuildingHub, and the work quality of all the employees was super.

Heli Nikula, Lempäälä

★★★★★

Excellent work with a decent price! The company kept us up-to-date of the state of the project via BuildingHub, and the work quality of all the employees was super.

Heli Nikula, Lempäälä

Reference images

From real customers — users of the BuildingHub

Financial figures

Revenue (million euros)

Year	Revenue (million euros)
2019/12	0,8
2020/12	1,5
2021/12	2,2
2022/12	2,2

Profit or loss for the financial year (thousand euros)

Year	Profit or loss (thousand euros)
2019/12	20
2020/12	50
2021/12	280
2022/12	320

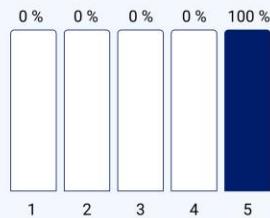


Reviews from users of the BuildingHub

Renomatic Oy

TOTAL SCORE: 5 (based on 5 reviews)

- Quality
- Price
- Keeping the schedule
- Communication
- Use of BuildingHub



- Quality
- Price
- Keeping the schedule
- Communication
- Use of BuildingHub

I was really pleased with the quality of the work! Thank you so much for renovating our house just as we agreed. Everything went super smoothly.

Marko Laajala, Tampere

- Quality
- Price
- Keeping the schedule
- Communication
- Use of BuildingHub

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Heli Nikula, Lempäälä

- Quality
- Price
- Keeping the schedule
- Communication
- Use of BuildingHub

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Marko Laajala, Tampere

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- Price
- Keeping the schedule
- Communication
- Use of BuildingHub

Excellent work with a decent price! The company kept us up-to-date of the state of the project via BuildingHub, and the work quality of all the employees was super.

Heli Nikula, Lempäälä

- Quality
- Price
- Keeping the schedule
- Communication
- Use of BuildingHub

I was really pleased with the quality of the work! Thank you so much for renovating our house just as we agreed. Everything went super smoothly.

Marko Laajala, Tampere