NTNU

Norwegian University of
Science and Technology

Delta: An App Supporting Children and Youth's Participation in Urban Planning

Mikael Reiersølmoen

Master of Science in Computer Science
Submission date: June 2016
Supervisor: Monica Divitini, IDI
Co-supervisor: Francesco Valerio Gianni, IDI

Norwegian University of Science and Technology
Department of Computer and Information Science

Abstract

Urban areas are constantly being redeveloped and expanded. In these processes it is the right of all citizens to have their opinions heard, but children and youth are not being sufficiently included. This remains a challenge, despite their rights, and acknowledgment that their opinions are valuable. One of the problems is that conventional methods used to facilitate public participation do not fit the need of children and youth. The objective of this research is to investigate how smartphones can be used to create new and innovative methods for children and youth to participate in urban planning, focusing on location-based participation and game elements. The research has been grounded in design science, which is driven by creating innovative IT-artifacts that solve real-world problems. The design cycle of design science comprise the main part of the work, and was done in three iterations, with an evaluation at the end of each iteration. The first iteration defined the concept and a low-fidelity prototype that was evaluated with expert interviews. In the second iteration a functional prototype was implemented and evaluated with a usability test. The third iteration refined the prototype, and ended with a field test. The result was an app that lets the user take location-based surveys, post suggestions, discuss suggestions with other users, and get points and achievements while using the app. Evaluations suggest that the concept is promising, and that there is a need for such a product. Location-based surveys can help children and youth gain new perspectives and provide better feedback, while the game elements can make the participation more engaging. The work has also uncovered many possibilities for how the concept can be extended in the future.

Sammendrag

Urbane områder blir konstant videreutviklet og utvidet. I disse prosessene har alle innbyggere rett til å få sin mening hørt, men barn og unge blir ikke tilstrekkelig inkludert. Dette er fortsatt en utfordring, på tross av deres rettigheter, og annerkjennelse av at meningene deres er verdifulle. Et av problemene er at konvensjonelle metoder for å fasilitere brukermedvirkning ikke er tilpasset barn og unge. Målet med denne forskningen er å undersøke hvordan smarttelefoner kan bli brukt for å skape nye og innovative metoder for brukermedvirkning hos barn og unge, med fokus på lokasjonsbasert medvirkning og spillelementer. Forskningen er forankret i "design science", som er drevet av å skape innovative IT-produkter som løser problemer i den virkelige verden. Hoveddelen av arbeidet er gjort i en designsyklus på tre iterasjoner, med en evaluering på slutten av hver iterasjon. Den første iterasjonen bestod av å definere konseptet og lage en enkel prototype, som ble evaluert i ekspertintervjuer. I den andre iterasjonen ble funksjonalitet lagt til prototypen, og den ble evaluert med en brukervennlighetstest. Den tredje iterasjonen bestod av å videreutvikle prototypen, og den ble evaluert etter en felttest. Resultatet av arbeidet er en app som lar brukeren ta lokasjonsbaserte spørreundersøkelser, poste forslag, diskutere forslag med andre brukere, og få poeng og utmerkelser for å bruke appen. Evalueringene foreslår at konseptet er lovende, og at det finnes behov for et slikt produkt. Lokasjonsbaserte spørreundersøkelser kan hjelpe barn og unge å få nye perspektiver og gi bedre tilbakemeldinger, mens spillelementene kan gjøre medvirkningen mer engasjerende. Arbeidet har også fått frem mange muligheter for hvordan konseptet kan bli utvidet i fremtiden.

Preface

This submission is my master thesis, written for Department of Computer and Information Science, at Norwegian University of Science and Technology. It concludes a two-year Master's degree programme in computer science with a specialization in software.

First of all I would like to thank my supervisors Monica Divitini and Francesco Valerio Gianni for their invaluable feedback and motivation throughout the work. Your guidance has really helped me to stay on track and structure my work, and I am glad for the opportunities you have given me to share my work with others.

I would also like to thank:

- The experts who volunteered to evaluate the concept at an early stage
- The students who volunteered to walk around campus with a GoPro on their head while conducting a usability test of the prototype
- The four students who volunteered to spend the first hours of their summer vacation to test and evaluate my prototype out in the cold
- Steffen Wellinger and Thea Hougsrud Andreassen for their enthusiasm, motivating feedback, and help with the field testing
- The two architects who provided relevant content for the surveys in the prototype

Trondheim, June, 2016

Contents

List of Tables

List of Figures

Definitions

Public participation	Induviduals who are affected by a decision are involved in the decision-making process
Situated engagement	Public participation taking place at a location relevant to the decision-making
App	A computer program that is design for, and runs on smartphones

1 Introduction

1.1 Problem definition

Urban areas are constantly being redeveloped and expanded. In these processes it is the right of all citizens to have their opinions heard, but children and youth are not being sufficiently included. Historically there have been times when children were not seen as rightful citizens, but now the rights of children are recognized and stated through article 12 of the UN Convention on the Rights of the Child. It has also been recognized that children's contributions are important [4]. Despite this, the problem of children's participation in urban planning remains. One of the problems is that conventional methods of public participation in urban planning fail to engage, and create a high threshold. Most children have not yet been involved in planning processes that affect them, so there is a need for new ways to include children in public participation [5].

1.2 Research question

This research set out to create new and innovative ways to include children and youth in public participation, with a focus on urban planning. This should be done by utilizing smartphones and their capabilities. The main research question is:

RQ: How can a smartphone app be developed to support children and youth's participation in urban planning?

To narrow the scope of the research, two sub research questions have been defined:

SRQ-1: Can situated engagement increase awareness of challenges and opportunities?
SRQ-2: Can game elements motivate to use the app?

One of the goals of the solution will be to support situated engagement. Situated engagement means that participation happens at the location that is under discussion. The rationale for this goal is connected to the complexity of urban planning, and that methods of participation should match the capabilities of participants. The idea is that it is easier to respond to something that is in front of you. In this regard it will be interesting to see if situated engagement can not only make it easier to respond, but also increase a participants awareness of challenges and opportunities connected to a specific planning project.

Urban planning is not only complex – it is probably also perceived as something uninteresting by most children and youth. It is therefore a goal to create a solution that is engaging by adding game elements.

1.3 Research method

To answer the research questions, the work has been done in a systematic and scientific way. The next sections describe the overall research paradigm of this work, and the different activities that comprise the work.

1.3.1 Research paradigm

This research is grounded on the design science research paradigm, which in short terms seeks to create innovative IT artifacts that addresses real-world problems [6]. Artifacts are not created only for the sake of innovation, but should be relevant for the application domain. This is based on the argument that justified theory and effective artifacts are equally important, which means that the rigor of the research process and the practical implications of the created artifact are valued equally.

The research activities of design science are described in [7] and provide a conceptual framework, as well as guidelines for effective design science research. To further help researchers design and execute design science research projects of high quality, three distinct cycles have been identified. These cycles are shown in Figure 1.1.

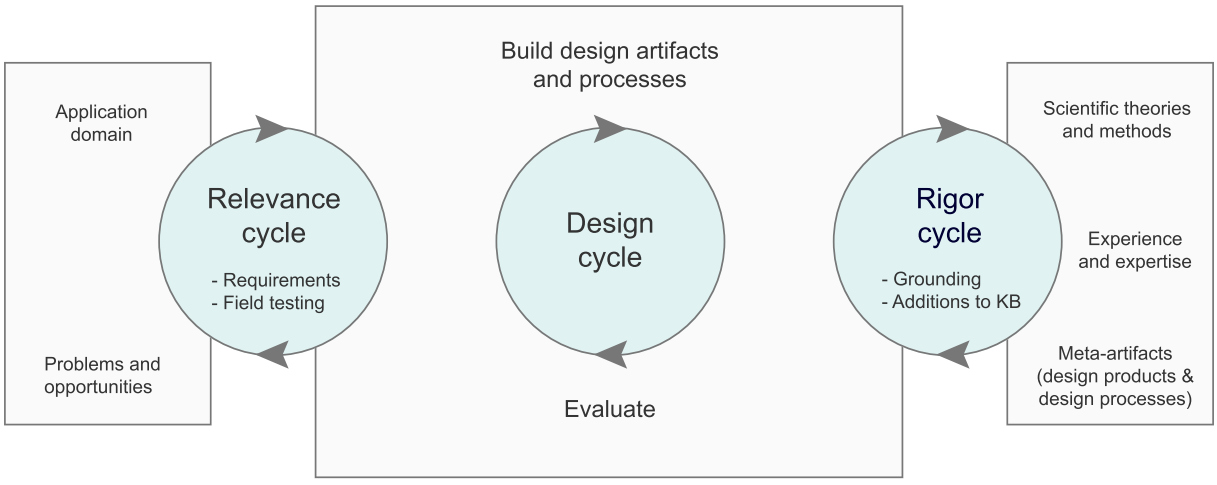


Figure 1.1: The three cycles of design science research, adapted from [3]

1.3.2 Research activities

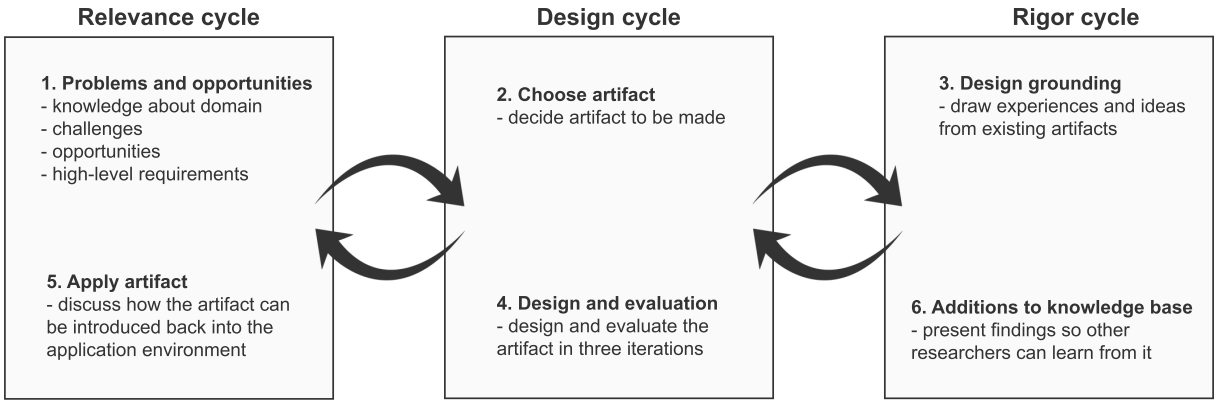


Figure 1.2: Research activities within the context of design science, adapted from [3]

Problems and opportunities

The application domain of this research has been children and youth's participation in urban planning, and the problem that many are not being heard. The first step consisted of attaining knowledge about the domain, investigate underlying challenges, discover opportunities, and eventually identify high-level requirements for an artifact to solve some of the challenges. It was during the autumn project that most of this step was undertaken. It started with an initial review of literature on the topic, which resulted in a set of challenges regarding children and youth's participation in urban planning. A systematic literature review was then conducted to explore previous attempts to face these challenges. The review highlighted opportunities for an ICT-artifact to help solve the problem. Based on the work from the autumn project, four high-level requirements for a solution was identified.

Artifact

This step was to decide what kind of ICT-artifact was going to be made.

Design grounding

An important part of design science is to draw from the existing knowledge base. So when the ICT-artifact was briefly sketched, it was natural to review existing artifacts of the same nature. This was done by undertaking a state of the art review, and use the high-level requirements as guidelines for drawing relevant experiences and ideas for the design.

Design and evaluation

This was the main step and consisted of three iterations with evaluations. The first iteration defined the concept, and a low-fidelity prototype was created, which was evaluated with expert interviews. In the second iteration the prototype was made functional and tested in a usability test. The third iteration refined the prototype and tested it in a field test. Figure 1.3 illustrates this process.

Apply artifact in domain

Ideally, the resulting artifact of design science research should be field tested, evaluated and introduced back into the application domain. Because of the limited time frame, the whole process is out of scope for this thesis, but dialogs with various stakeholders have started, about the possibility of applying the artifact.

Additions to knowledge base

Insights gained from the work will be presented in this report. A publication of the work is also planned.

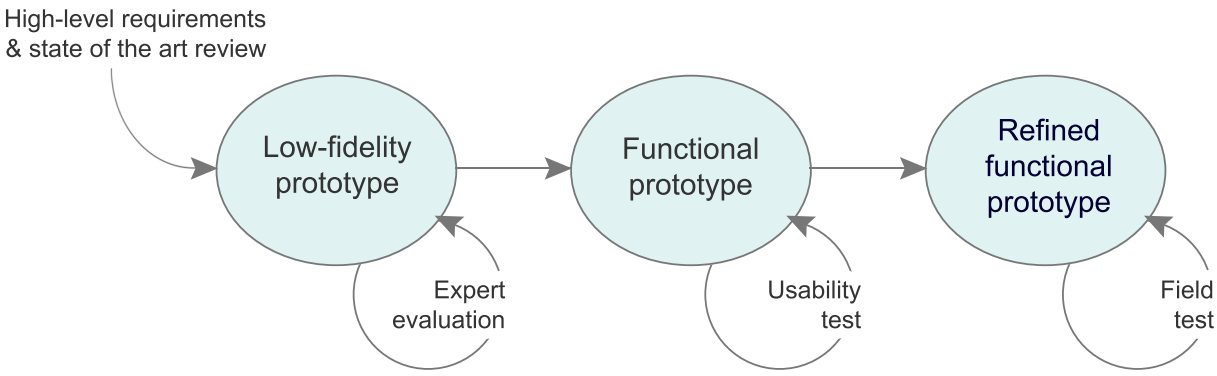


Figure 1.3: The three iterations of the design cycle

1.4 Outline

This chapter has given an introduction to the problem definition, the research questions and the research method. The next chapter will elaborate more on the problem, and present the high-level requirements that have been identified. Chapter 3 present a state of the art review of smartphone apps that support situated engagement in urban planning. Chapter 4 presents the final concept that was developed during this work, as well as the final version of a prototype. Each of the next three chapters presents one design iteration. Each chapter comprise description of the design process and evaluation method, and presentation and discussion of the result. The final chapter concludes the work by summarizing the work and contributions. Finally there will be some thoughts on limitations, reflections, and future work.

2 Problem elaboration

2.1 Youth's right to participate

Today urban areas are growing fast and new cities are constantly being built. In these processes, it remains a challenge to include the opinions of the public. This holds especially true for younger people. Historically there have been times when people believed that children should be shielded from the public life. Adults knew what was best for them, and thus they did not have a say on matters that affected them. Since the 1960's the matter on children and public participation has gone through several stages [4]. Perhaps most importantly, the rights of the child has been recognized and stated through the UN Convention on the Rights of the Child.

Article 12 of the convention states that children should have the freedom and opportunity to express their views in matters that affect them. This right also applies to urban planning, since children are considered rightful citizens. They are affected by their urban environment, and have needs and wishes for how their surroundings should be, although this might differ from what adults think is best for them [8]. Besides the right to participate, there are several other reasons why they should have the opportunity to do so. Children have a great ability to evaluate their environments and come up with ideas of their own [9, 10, 11]. If children are included in urban planning it can positively affect them, improving their "environmental awareness, knowledge and skills" [12, p6] and teaching them how to negotiate and respect other people's views [13].

Despite the increased recognition of children as actors in the public, it remains a challenge to sufficiently include them in urban planning. Attempts to do so can often be described as being tokenistic, mostly including them for symbolic purposes and not supporting meaningful participation. The reasons why this is still a challenge are many. Although literature suggests

that children have the capacity to contribute, this might not be recognized by those facilitating public participation. In such cases children will most likely end up outside the planning process, as conventional methods of participation, like public hearings and committee groups, fail to engage children. If children's capacities really are recognized, there should be an effort to create new, innovative methods of participation that suit them well, and in a best possible way utilizes their knowledge and ideas in the planning process. When children are included, another challenge is how their contributions are used. Conflicts of interest will appear, as children and adults even have different views about how a playground should be made [8]. This touches upon the question of level of participation, a discussion sparked by [14]. The discussion deal with who designs the participation process, how contributions are used, how well children are informed on the process, and whether or not the decision-making is shared with children.

2.2 Engaging young people in urban planning

In a specialization project prior to this thesis [1] I reviewed 14 case studies of urban planning projects that aimed to include children and youth. The intention of the review was to get a better knowledge of the domain of children's participation, get inspired by different methods of participation, and gather information that might be useful to understand how this process could be augmented by technology. All projects somehow aimed at better including children and youth in planning projects, but in several different ways. Some projects did experiments with imaginary scenarios to test how well a particular method worked, or to teach the participants about urban planning. Other projects gathered opinions and ideas on various levels; in some cases opinions and ideas were gathered with no plan for how the contributions were to be used, while in other cases the contributions were connected to specific agendas, for instance a regeneration project or the development of new neighborhoods. Some of the projects even let participants collaborate on design plans that were proposed to the planning authorities.

One of the main contributions of the review is an overview of methods that were used to facilitate participation. This overview is presented in Table 2.1, and categorizes the methods into five types: diagnostic, expressive, situational, conceptual and political. It is clear that many unconventional methods were used, which were also some of the most common ones, such as: free drawing, walking tours, photography, specific drawing task, and artwork. Each project utilized almost four different methods on average, and typically from two or more method types. Diagnostic and expressive methods were clearly the most used.

The reviewed projects show promising attempts to overcome tokenistic inclusion and use methods that engages children and youth. They are, however, costly and time-consuming and only includes a small number of participants. There is a need for new forms of- and opportunities for participation to be developed, as most children and youth have yet to experience being actively involved in planning processes that affect their lives [5]. Apps seem promising in this regard, and in the next section I will take a look at how they can overcome some of the restrictions of conventional methods of participation.

Table 2.1: Overview of methods used to include children and youth in land-use projects. [1]

Type of method	Method	Explanation
Diagnostic	Walkshop Photography Guided drawing Map marking Survey	Methods used to evaluate an environment.
Expressive	Free drawing Artwork Presentation Modeling Writing	Methods for letting the participants to express their views with creative work.
Situational	Brainstorming Simulation Focus group	Methods in settings that open for direct feedback, resolving problems and discussing ideas.
Conceptual	Informing	Methods facilitating learning.
Political	Showcase	Methods aimed for political influence.

2.3 Opportunities for mobile and situated participation

In general conventional methods of public participation like public hearings, questionnaires and committee groups have failed to engage the majority of the public, and there is a call for more collaborative ways of participation, where opinions and knowledge of citizens and stakeholders are taken into account through authentic dialogs, building social capital and trust [15].

Most conventional methods of public participation are tied to a specific time and space, which cause several practical problems, for instance reluctance to participate due to the time consuming process, high costs for the government, and difficulty of including disadvantaged groups [16, 17]. Web-based solutions have made it possible for people to contribute from their own desktop computers, independent of time and location. There is, however, the risk that such methods become unengaging.

Situated engagement describes participation with mobile devices at the location that is under discussion, and creates engagement through immersive experiences [18], which generates meaning and relevance for the user, which might lead to more sustainable engagement [19]. Situated engagement is dependent on the location of discussion, but not of an organized event at a particular time. This approach could save cost and time, and provide flexibility for the participants. There is a clear connection between the notion of situatedness and some of the mostly used methods from Table 2.1: walking tours and photography. These two methods were often combined by letting participants walk around and experience the location that is being discussed, while using photography to focus the attention and describe assessments. Relevant to these methods is Lawrence Halprin's concepts of walkshops that combine walking tours with specific tasks along the way, and states that discovery through personal experience in this way does not hinder creativity, like many conventional methods [20].

As smartphones have increased their capabilities and become widely available the last years, they are a natural candidate for facilitating public participation. Smartphones have become personal devices that we carry around most of the time, and with an appropriate app people could be empowered to engage in urban planning as they move through places they are interested in, which normally is in close proximity to people's homes [21]. The opportunities for mobile participation are also illustrated in an interview with 13 city officials and political decision makers in urban planner, who preferred a web-based mobile solution over other concepts such as interactive public screens and design tables for multiple users [22]. Participation via smartphone is also expected to appeal to youth who normally do not interact with government services [23], as they are early to adopt new technologies and shape how they are used [24].

2.4 High-level requirements

Following are the high-level requirements for a solution that were identified based on the work from the autumn project. The id's will be used to reference the requirements later.

HLR1: Location-based
The solution should support key activities to take place at the actual location in which the user is providing feedback on. What remains to be decided is what the activities are, and whether some activities can be done at a later point as well. The basic idea behind this requirement is that the feedback will be based on the participants actual perceptions of the place. The review showed that walking tours (or so-called walkshops) were frequently used to let participants assess their environment and come up with ideas. The assessments and ideas were normally processed at a later point, typically in a workshop setting. This work seeks to investigate how more of the process can be done in-situ, and not being dependent on more conventional methods afterwards.

HLR2: Engaging
One of the goals for the app is to include the voices of more young people in urban planning, and therefore the user must be given an incentive to use the app – it must be engaging. Being location-based could be a first step of making the solution engaging. One place to look for inspiration could be geocaching. Common motivations to do geocaching are: social walking, exploring new places, collecting caches, social status online, competition and challenges [25]. Another source of inspiration can be drawn from the field of location-based games, to see how game elements might foster engagement.

HLR3: Collaborative
The solution should support collaboration among users of the app. The review illustrates the importance of collaboration, as all projects included collaboration in various ways. Collaboration helps create better ideas, represents the importance of negotiation in urban planning, and creates opportunities to share opinions.

HLR4: Project support
The solution should support engagement in actual projects. The review pointed out that in the cases where the participant's contributions resulted in changes, planning authorities had a key role in the project. Users should be able to engage in the things they care about, but if this is the only option it is less likely that contributions will result in changes. The solution should therefore support ongoing or planned projects, and not only gather opinions in general.

3 State of the art

There has been done too little effort to explore the possibilities to use smartphones in public participation, given their increased penetration the last years [26]. In a review of current attempts, it became clear that most of them were focused on a government context. Examples include solutions that enable citizens to report damages in a city, or provide up-to-date information about the city. [2] reviewed participatory apps and categorized them according to three dimensions of participation: type of data collected, information flow and empowerment. A summary of the categories is presented in Table 3.1. The review concluded that most of the efforts to facilitate participation with smartphones fall under the category of informing apps, which often involves the user providing information to the government, or the government simply informing the public. Apps that generates or collects more sophisticated data should strive to make the data more relevant for policy-making. It is also argued that there is a lack of apps that enable the public to participate in more profound ways, and dialog between stakeholders is pointed out as a feature to achieve this.

As a part of investigating how smartphones can be utilized to create profound ways of participating in urban planning, this chapter is dedicated to draw knowledge from previous work. The next sections explain the search strategy for finding relevant work, and present the findings and discusses how they relate to this work.

Table 3.1: Categories of participatory apps from [2].

Informing apps	Reporting apps: users report issues in their local environment directly to the responsible organization. Prepopulated apps: environmental data is previously collected and presented to the users.
Shared reality apps	Shared reality apps are more interactive than informing apps. Content is created by users, typically connected to a specific place, which can be discovered by other users. Prepopulated data might also be used and presented in an interactive way, for instance with augmented reality.
Trend monitoring apps	Trend monitoring apps are similar to reporting apps in that users report environmental data. They differ in the nature of the data, which in this category is more sophisticated, perhaps relying on sensor built in or connected to the smartphone. The organization collecting the data does not use the data to do small, concrete tasks, but to help understand and act on complex problems.
Integrator apps	Integrator apps are similar to trend monitoring apps, but rather than a one-way communication from users to app providers, these apps rely on a two-way dialog with the user.
Nudge apps	Nudge apps attempts to change the users behavior by various means of motivation and reward. Data on the choices the user make could be useful for planners on a strategic level.
Local network apps	Local network apps use open data and user-generated data to connect citizens within communities and inform everyday activities.
Citizen impact apps	Citizen impact apps collect input from citizens to be used by planners. Information flow is one-way, from user to planners.
Public dialog apps	Public dialog apps adds a level of interaction, and hence the dialog missing in citizen impact apps. Dialogs may be between citizens, or citizens and authorities.

3.1 Search strategy

Table 3.2 shows the search string used to find previous work to include in the state of the art review. I looked for scientific contributions that had utilized the smartphone for public participation in urban planning, that also met the following two criteria. Firstly, the solution should support situated engagement. Secondly, the solution should be either a citizen impact app or a public dialog app, which are categories from Table 3.1. This is because these categories provide the most profound types of participation, and there is a lack of such apps [2]. The goal of this work is to create an app that falls into either of these categories, so it is natural to review similar apps.

Table 3.2: Search string for finding previous work

(mobile OR app) AND (public participation OR civic participation OR citizen participation OR community participation OR public engagement OR civic engagement OR citizen engagement OR community engagement OR e-participation OR m-participation OR e-government OR m-government)

The search yielded 935 results on www.scopus.com. I attempted to narrow the search by adding words like ”situated” and ”location based” according to the first criteria, but it did not seem to make the results more relevant. Most of the 935 results could be excluded only based on the title. The number quickly came down to 18, and after reviewing the abstracts, and in some cases quickly scanning through the content, five articles remained.

3.2 Apps for situated engagement

This state of the art review focuses on apps that facilitates situated engagement in urban planning. Table 3.3 presents the five works that were selected. It shows the products of the works, which category from Table 3.1 it falls into, and the title of the article where the work was presented. The rest of this section will summarize each product and discuss how they relate to the high-level requirements previously identified.

Table 3.3: Articles selected for state of the art review

Reference	Product	Category	Article title
[27]	Mobile Democracy	Public dialog	Public Deliberation in Municipal Planning: Supporting Action and Reflection with Mobile Technology
[28]	Augmented Reality	Citizen impact	Smart-phone Augmented Reality for Public Participation in Urban Planning
[29]	FlashPoll	Citizen impact	A Mobile App for Citizen Participation
[30]	Tienoo	Citizen impact	A Mobile Phone Application for the Collection of Opinion Data for Forest Planning Purposes
[31]	Community Circles	Public dialog	Civic Engagement Meets Pervasive Gaming: Towards Long-term Mobile Participation

3.2.1 Mobile Democracy

Mobile Democracy was perhaps the first attempt at creating a mobile app for letting citizens participate in land-use planning. The solution consists of two parts: a mobile app and a web app for desktops. The app enables users to create topics about a specific location, which can be set manually or based on the user's current location. In addition to the location, a topic has a title and description. When a topic is created it becomes visible for all users, who for every topic can express agreement/disagreement, comment and upload photos. Topics are discovered by browsing a map, or showing all topics in a list, or by receiving a notification when in near proximity of a topic. The app also supported augmented reality, allowing the user to move around and look at 3D models on the screen, projected on top of the image from the smartphones built-in camera.

Engagement: The solution engages users both when being at the relevant location and afterwards, with the rationale that users can reflect in-action and on-action. Reflection-in-action is supported by allowing the user to create new topics at the current location, capturing responses based on experiences of the immediate context. Reflection-in-action could also be when the user reacts to a topic, while in the location of that topic. Reflection-on-action is supported especially by the web app, allowing user to conveniently browse and respond to topics from their computer, when they have more time and information available. The solution provides an immersive experience with the use of augmented reality.

Collaboration: Users are encouraged to collaborate by adding comments and photos to a topic, and express agreement/disagreement. The map where topics can be browsed shows how many comments each topic has.

Project support: The solution is meant to support predefined topics along with those created by users. The ability to add 3D models are necessarily only available for predefined topics. This means that project managers may create topics, add 3D models, and receive feedback from citizens in the form of comments, photos and agreement/disagreement.

3.2.2 Augmented Reality

Around the same time as Mobile Democracy was developed, other researchers developed a prototype focusing only on augmented reality. The approach is a bit different. While Mobile Democracy used GPS and compass to continuously position imaginary buildings on the screen, the focus of this research was to overlay models on existing buildings. A panorama picture of the building was taken and used to calibrate and correctly place the model on top of the building. The user could therefore only tint and pan the phone to look at the model, but not move around. In addition to looking at the model, the user could change between different models, and rate each of them with a smiley on a seven-point scale.

Engagement: The researchers wanted to find out if augmented reality would increase public willingness to participate in urban planning. It therefore becomes clear that augmented reality was used as a tool to engage. The use of augmented reality to overlay models on the screen also implies that the reflections and responses are based on situated observations. Combined, augmented reality and in-situ action is likely to create an immersive and engaging experience.

3.2.3 FlashPoll

FlashPoll is an app allowing users to answer location-specific polls, and originated from the impulse of creating a solution that would overcome the shortcomings of face-to-face participation. Polls are meant to be answered by citizens as they move into an area where a poll is active. The results are anonymously sent to urban planning administrators, and users will also see the results of a poll after finishing it. The goal of the app is to increase productivity and responses, while lowering the cost of urban development.

Engagement: One of the shortcomings of face-to-face participation is probably the difficulty of engaging people (although not mentioned in the paper). The proposed solution is engaging by being available on a smartphone, connecting a poll to a specific area, and limiting the length and complexity of polls. The paper asks the question of who would use such an app, and tests revealed that most the of the people interested in testing the app were middle-aged men, who were interested in technology and already active citizens. Further tests were planned to investigate the potential of engaging younger people through the app.

Project support: The solution is created with project mangers in mind, and the final goal was to let public institutions independently create and run polls. The papers states, among other things, that the solution should provide a natural platform for dialog, but is limited to the polls

created by project managers.

3.2.4 Tienoo

Tienoo is an app developed in order to collect location-specific opinions about forests in Finland. The use of an app for this purpose was argued to be especially useful in a forest, where there are less landmarks to orient around. Gathering opinions about specific locations in the forest in retrospect is hence difficult. A mobile app allows data collection to happen in real-time, and be connected to a specific location with GPS coordinates. The main functionality of the app was designed as a game inspired from geocaching. The users were shown a map with 16 locations pin-pointed. At each location was a banner with a code that the user would type into the app to confirm that they had found the place. Three questions would then be prompted, each consisting a statement and a five-step scale to express agreement or disagreement. Users also had the opportunity to give feedback outside of the game, at any place. They would then be prompted three random questions to be answered before a free-text feedback could be given. The game element of the app was argued to be important for engaging people to use the app, including children and youth who would normally not be interested.

Engagement: The solution engages users by having them find physical banners at specific locations, much like geocaching. In addition to verifying the location of the user, the banners are part of the game element of the app, where the point of the game is to locate the banners. In an urban environment such banners might not be necessary. The codes on the banners could be replaced by using the GPS-signal from the smartphone to verify the users position, and urban landmarks could be used as the rewards to be found. The app also makes it very easy to give feedback with only three questions at each location, all in the same format, which lowers the threshold of participation.

Collaboration: The opinions gathered are only made available to the planning authority, so the solution does not support collaboration in this manner. The app does, however, have the option to select how many people there are in the group, which recognizes that people are likely to go find the banners as an collaborative activity. This is likely, as one of the motivations for geocaching is the social part of walking [25]. Whether or not the opinions should express an consensus of the group or individual opinions is unclear.

Project support: The main functionality of the app, the game, resolves around locations predefined by those managing the app. Being important for engaging the users, the game is also designed to let planners gather opinions about locations they consider important. The researcher

also recognizes that users should be able to give feedback on the places that are important to them, also allowing opinions to be given outside of the game.

3.2.5 Community Circles

The concept Community Circles was developed in order to enable long-term participation in urban planning using smartphones, grounded on ideas from location-based games (pervasive games). A questionnaire taken by 27 active players of pervasive games revealed social interaction, collaboration, exploration, physical activity, achievements, and novelty as important factors of such games. The game allows users to create location-specific issues, ideas, opinions or polls, comprising a title, location, picture, mood and description. Other uses can browse, comment, and upvote or downvote each contribution, which can increase its impact. Increased impact is visualized as the circle representing a contribution grows. As the impact of contributions increase and impact circles intersect, communities emerge. Players are encouraged to keep making contributions to expand and keep communities alive, as contributions without activity eventually will disappear. Each user has an individual score that increases by performing activities within the game.

Engagement: Wants to engage by integrating elements from pervasive games into the experience. Comments support social interaction, and creation of communities creates a notion of teamwork and competition. Activities are rewarded with points that increase each player's score, and extra points are given to encourage certain activities. Extra points are for instance rewarded for exploring new places and contribute in other communities than your own.

Collaborative: Collaboration is supported in several ways. Users can comment and vote on contributions, which is meant to create meaningful discussions. The creation of communities require contributions to be made close to each other, and encourage users to work together to expand a community. Several users can also be added to a single contribution, which will yield extra points.

Project support: The concept of communities is based on the idea of users contributing to the places that they care about, without involving the city representatives. The game does, however, enable both players and city representatives to create contest, requesting contributions in certain locations.

4 Delta! – a concept for participation in urban planning

This chapter describes the final concept and prototype that have been developed throughout this work. The design of the concept and prototype was motivated by the work from the autumn project, the state of the art review, and the evaluations after each iteration of the design process.

4.1 Concept

The concept consists of two parts: an app for citizens, and an interface for planners. The app is designed to enable and motivate young people to participate in urban planning, while the interface is to enable planners to add and manage projects in the solution. In the app citizens can get an overview of urban planning projects that are happening in their area, and there are several ways of contributing: complete surveys, post suggestions, and discuss suggestions. These functionalities are paired with game elements such as scores and achievements. The interface for planners provides a way to add information about projects, create surveys, see data collected from the surveys, and browse suggestions and comments posted.

The decision to make the concept resolve around projects is related to HLR4, and is meant to increase the probability that contributions from the public result in change. The inclusion of surveys is inspired by FlashPoll and Tienoo from the state of the art review, while how the surveys are designed is largely inspired by the concept of walkshops from the autumn project [1], which relates to HLR1 and HLR2. The ability to post and discuss suggestions satisfies HLR3, as it adds dialogs between citizens. The added game elements relate to HLR2, as it is meant to make the participation engaging. The rest of this section presents the concept in more detail, and further explaining the rationale for design decisions.

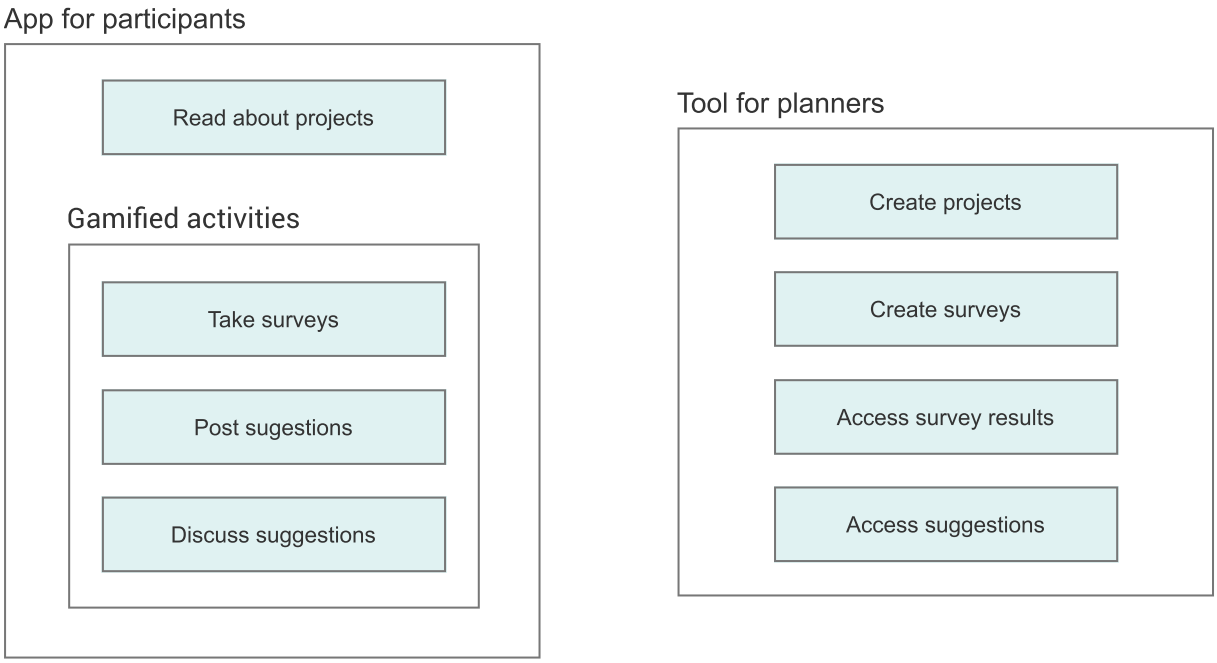


Figure 4.1: Concept overview

4.1.1 Projects

The concept resolves around urban planning projects that should be added by planners, which will happen from an interface separate from the app. This means that every survey is connected to and resolves around one specific project. Suggestions posted by users must likewise be posted to one of the active projects. Exceptions are scores and achievements, which are not project-specific.

Location-based: The app shows the location of the planning projects on a map so users can get an idea of where it is. Perhaps most importantly this functionality enables the user to get an overview of what planning projects are currently under development in their area.

Project support: Participation resolves around projects to increase the probability that contributions are relevant and can have a real impact.

4.1.2 Survey

A survey is designed like a treasure hunt consisting of several tasks, where each task is connected to a specific location. To answer tasks the user must be in close proximity to the location of the task. After finishing one task the user must navigate to the next with the help of a textual description which references the map and elements of the surrounding environment. To help with the navigation, the user can continuously see the distance from the current position to the position of the next task.

Location-based: The idea of designing the surveys as a form of treasure hunt is mainly drawn and adapted from Lawrence Halprin's concept of city walks, which he typically used in the first stage of a public planning process. Participants would be given a set of instructions to guide them to certain locations, where they would be asked to sketch any ideas and thoughts they had about the place [20]. The walk was designed to bring awareness of problems and opportunities in the city [32]. The Tienoo app [30] had participants navigate to certain locations in a forest by following marks on a map, which probably was necessary for the participants to find the locations in an environment with few elements to navigate by. Following a mark on a map might seem like the easiest way to navigate also in an urban context, but going back to the concept of a city walk, the intention is not simply getting from one place to another as quickly as possible, but to see the connection between places [32, p136]. This brought the idea of a treasure hunt, where only the first location is marked on the map, and the rest must be found by following directions given. This forces the participant to look up from the smartphone, and should help them become aware of the environment.

Engaging: Not only does the treasure hunt intend to increase awareness, but also introduces a game element to create a more challenging and engaging participation process. The concept is meant to engage in a similar way as geocaching. The task of finding the next location in the treasure hunt is not supposed to be difficult, and everyone should be able to finish a treasure hunt. Directions too difficult to follow will likely work against its purpose and decrease engagement.

Collaborative: Although treasure hunts can be finished by one person, it is likely an activity that people will enjoy doing together with someone, much like the social walking aspect of geocaching [25]. Participants are therefore encouraged to cooperate in finding the locations of the treasure hunt, while giving individual answers to the tasks. Even though the surveys are individual, this cooperation could prompt the participants to reflect on the tasks together.

Project support: Such surveys as treasure hunts support real projects by letting planners design the route they want the participant to walk. The directions does not have to only describe how to get from one place to another, but could also ask the participant to pay attention to something specific along the way. In this way the planner can prepare the participant for the coming task, and is a tool they can use to gather relevant data.

4.1.3 Survey tasks

There are four different types of tasks, and each survey can combine all of them. A task consists of one or more questions, and the difference in the task types is how the questions can be answered. The first type provides a linear scale of alternatives, where the planner choose the number of steps and step values. The second type is answered by selecting one of many alternatives for each question. The third type is almost like the second, but several alternatives can be chosen for each question. The last type support one question and one answer in the form of free text. Figure 4.2 shows what each task type could look like. In addition to what the figure shows, each task type can show an image at the top.

Figure 4.2: Type of tasks: linear scale, multiple choice, checkboxes and free text.

Location-based: As already mentioned, one intention of a treasure hunt is to bring awareness of problems and opportunities. The tasks are meant to benefit from this increased awareness by asking questions relevant to the current location or the route that led there. This situated engagement is believed to increase the quality and relevance of responses, as well as being more engaging for the participant than a question in a regular survey.

Project support: The definition of survey tasks is decoupled from the app itself, and the interface to create tasks should be open only for planners. This is the most important part of the concept for making sure that real planning project can be supported. The planners have many possibilities when designing the tasks. They can decide number of tasks, number of questions in each task, number of alternatives for each question, and whether or not the task should show an image.

4.1.4 Suggestions

Suggestions provide participants with another way of contributing to a project. Suggestions are separate for each project, created solely by participants, and visible for all users of the app. A suggestion is more open and not tied to specific locations and questions defined by planners. A suggestion consists of an image, a title and some text describing the suggestion. Other users have two means of discussing results. They can select if they agree or disagree, and they can post comments.

Location-based: The high-level requirements state that the solution should support key activities to take place at the actual location in which the user is providing feedback on. The treasure hunt is this key activity. Adding and interacting with suggestions can happen at a later point, when the user is no longer at the actual location. Some participants will probably like to post spontaneous suggestions right after completing the treasure hunt, or even as they do it, while others might prefer to spend more time to reflect before posting a suggestion. Interacting with suggestions by commenting or expressing agreement/disagreement is expected to happen mostly at a different location than the suggestion is about. This will expand the engagement to continue also after completing a treasure hunt. In a sense the treasure hunt is only the beginning, preparing for and encouraging further involvement.

Engaging: Suggestions foster engagement since participants can find suggestions that cover topics they are interested in and respond to them. If a user finds none of the suggestions interesting, the act of posting a suggestion can also be engaging by seeing how other users respond to their suggestion. Getting good feedback from users will likely create a sense of reward and encourage continued engagement.

Collaborative: The opportunity for users to comment and express agreement/disagreement on other user's suggestions is the most important way in which the app supports collaboration among users, as it adds a dialog between citizens.

Project support: While treasure hunts designed by planners are likely to increase the relevance of contributions, they also limit the participants freedom to express their opinions about what they want. This is why the opportunity to post suggestions was added as an additional contribution method, empowering the participant to share what is important for them regarding a project.

4.1.5 Game elements

The final aspect of the concept is that certain activities are rewarded with points and achievements. Points are rewarded according to Table 4.1.

Table 4.1: Actions and their yielded points

Action	Points rewarded
Complete a survey	50
Complete a survey with a friend	75
Post a suggestion	25
Write a comment	10
Agree / disagree on a suggestion	10
Receive agreement on suggestion	15
Receive an achievement	25
Have suggestion or comment removed as inappropriate	-100

Achievements can be rewarded when a participant has taken two surveys, written ten comments, posted five suggestions, received five agreements and so on. The total score and obtained achievements will be presented on each users profile page, which will be visible for other users. In addition to individual profile pages, there is a top list showing the users with the highest score. By clicking on a user in the list the profile page for that user appears. To get an overview of activities done in the app, each user can view a log of activities they have done along with how many points each activity generated.

Engaging: While the survey adds engagement by giving the participant a challenge, the game elements are intended to increase engagement by rewards and competition. The rewards are mainly the points received for actions, as well as the virtual achievements represented by a badge with explaining text. These rewards manifest themselves on a user's profile page, which

is visible to other users. Another type of reward, as already mentioned, is positive feedback on suggestions. Receiving an agreement on a suggestion yields 15 points. Whenever someone agrees with your suggestion it will appear in the activity log. The competition element is introduced by the list of users with the highest score. The intention is that this should create a healthy competition between users. Given that the app has active users, perhaps the best way of getting a high score will be to post a suggestion that receives many agreements, which also encourages the users to post suggestions of high quality.

4.2 Prototype

To present the app that has been developed, this section goes through an example scenario starring the imaginary person Emma. The screenshots included are from the actual app.

Table 4.2: Scenario of use

Emma is 17 years old and somewhat interested in participating in urban planning, but she does not get informed about what is going on in time. She typically reads something online in the local newspaper, but then it seems like a detailed plan has already been made, and she does not know how she can contribute. One day at school her class is introduced to an app that the municipality wants to use to collect the opinions of youth regarding an urban regeneration process at Nyhavna[1] in Trondheim, Norway. Data collection includes responses to a survey, suggestions from the youth, and discussion of the suggestions. The survey is like a treasure hunt, so to take it pupils are required to go to Nyhavna. Since the school is not far away, pupils are allowed to go there in small groups.

4.2.1 Register and log in

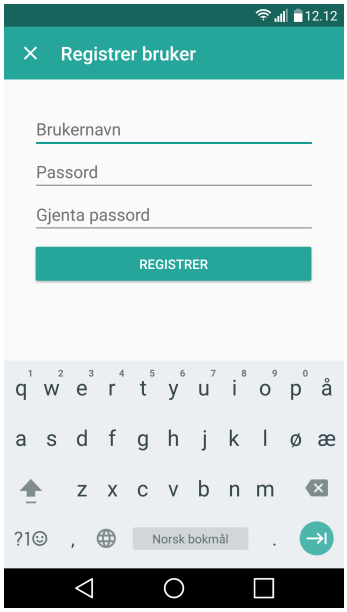


Figure 4.3: Register screen

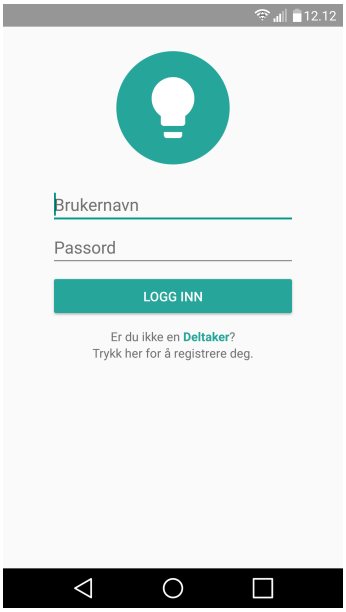


Figure 4.4: Log in screen

Emma downloads the app, registers a user with her favorite online username and logs in.

[1] This is an important local project that has been used in the final evaluation.

4.2.2 Get information about projects

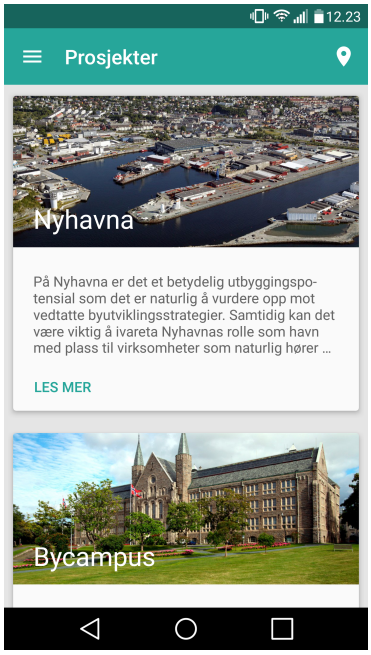


Figure 4.5: List of projects with essential information

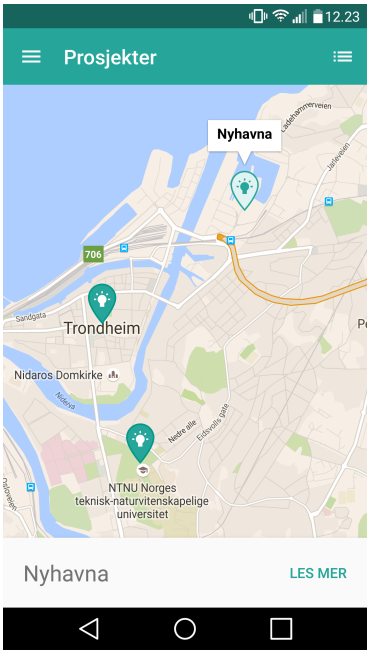


Figure 4.6: Projects visualized on a map

Figure 4.7: Project page with more information

She is first presented a list of current urban planning projects. There is a picture, a title and a short text about the project. She recognizes the location of some of the projects just from the title or looking at the picture. She does not know where Nyhavna is, but by touching the button in the top-right corner all the projects are visualized on a map. By zooming in on the location of the Nyhavna project she gets a better idea of where it is. Emma navigates to the project screen for Nyhavna and reads some more about the project. She then teams up with one of her friends to take the survey and starts by pressing the button with a compass.

(a) Take the survey

(b) Post a suggestion

(c) Discuss suggestion

Figure 4.8: Ways to contribute to each project

4.2.3 Take surveys

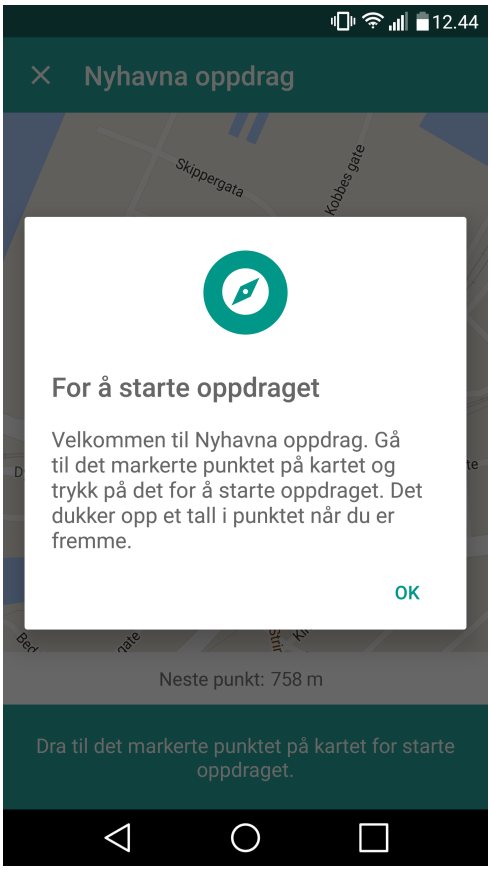


Figure 4.9: Dialog explains the user to go to the start location

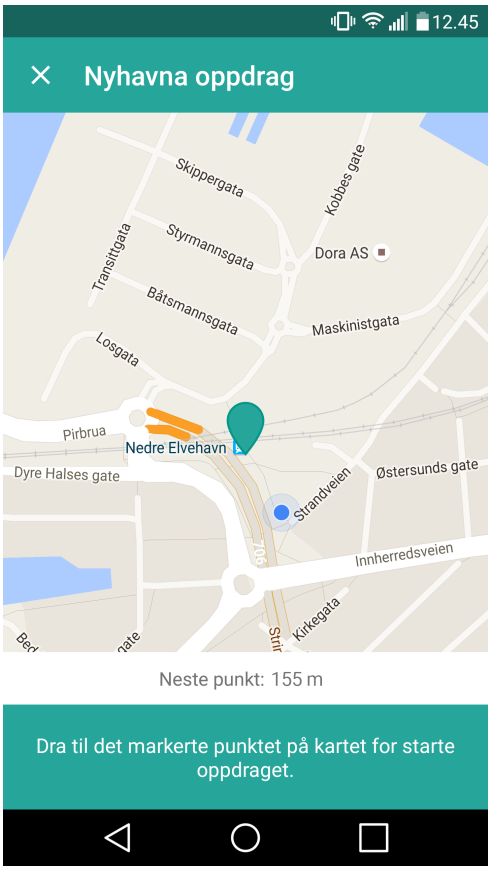


Figure 4.10: Map with current location and distance to destination

First a short text appears, explaining that she has to go to the location marked on the map to start the survey. A map shows the location where they have to go. By zooming out Emma can see her current position, and it is shown how far away she is from the destination. They then start making their way to Nyhavna.When Emma gets close to the starting point her smartphones vibrates and the number ’1’ shows up inside the pin.

Figure 4.11: Example of task with check-boxes

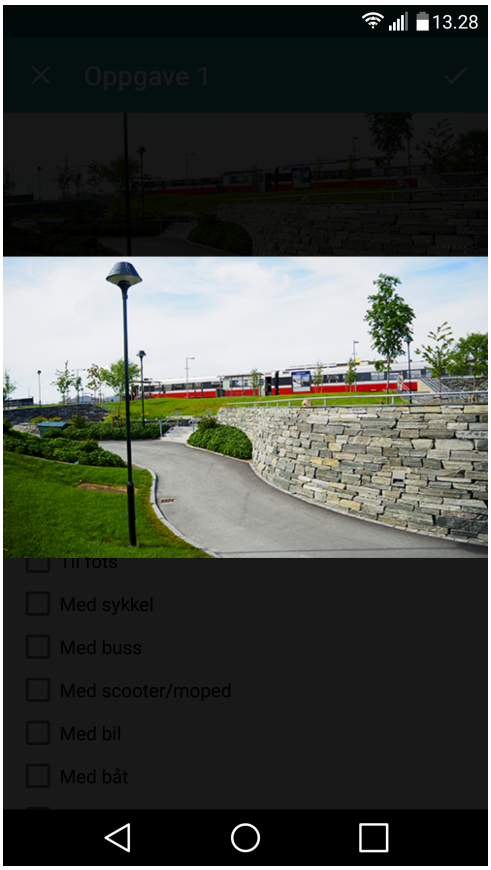


Figure 4.12: Image view shows the full width and height of images

When she touches the pin the first task appears. It has a picture of the train station close by, which assures her that she is at the right place, and a question with several alternatives. The question is how she would like to do her daily travels if she lived in that area. She looks at the alternatives and talks with her friend about how they both love the freedom of using the bicycle to get around. She selects bicycle, but also bus, since that is her favorite type of transport in the winter and when it is raining. By touching the check mark in the top-right corner the answer is posted.

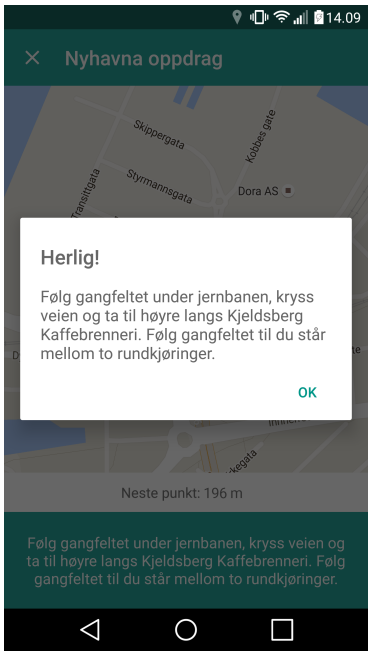


Figure 4.13: Description of how to get to the next task

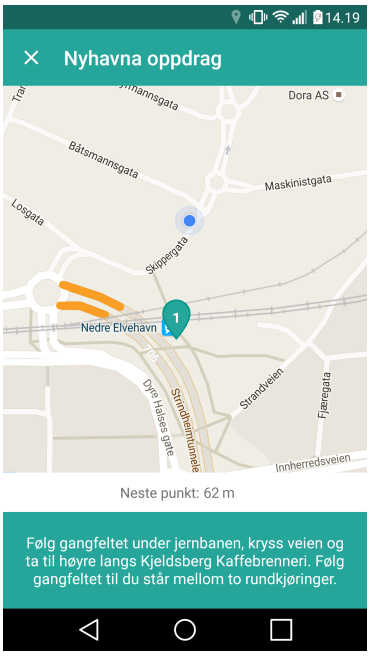


Figure 4.14: Map when navigating from one task to another

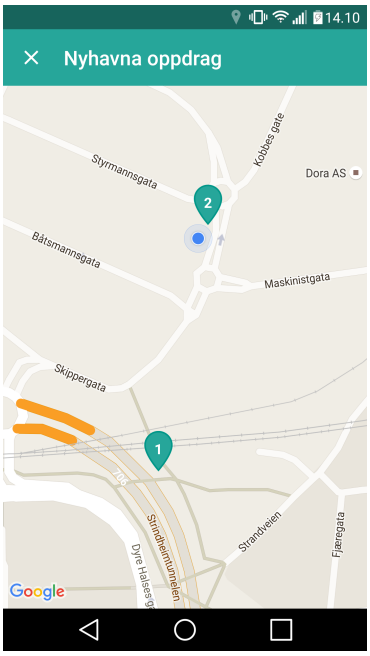


Figure 4.15: The map when a user gets close to the next task

A description of how to find the location of the next task then appears. Dismissing the dialog brings back the map, but the description is still visible at the bottom of the screen. Emma understand which way she is supposed to go, and starts walking. She keeps the app open, and verifies that she is on the right track by seeing that the distance to the task decreases as she walks. After a while she takes another look at the description, sees a building that is referenced and continues to walk. When she arrives close to the next task, her smartphone vibrates again, and a pin with the number ’2’ appears on the map. She touches the pin and opens the second task.

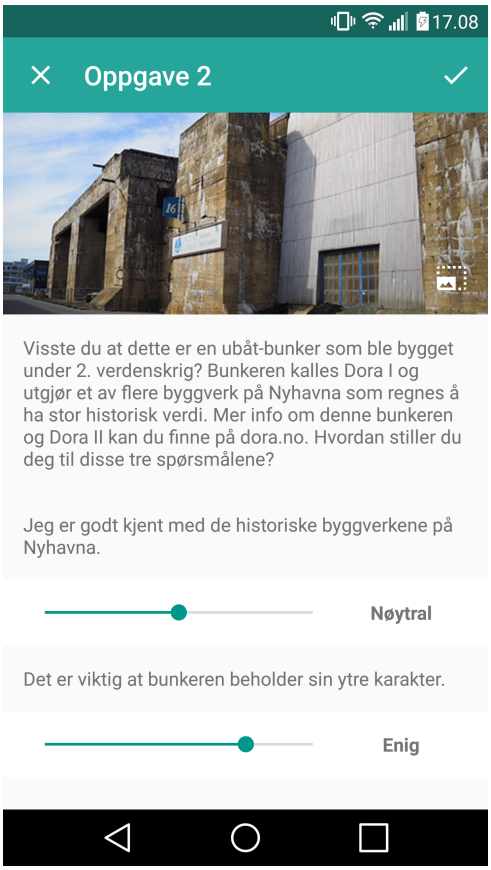


Figure 4.16: Example of task with linear scales

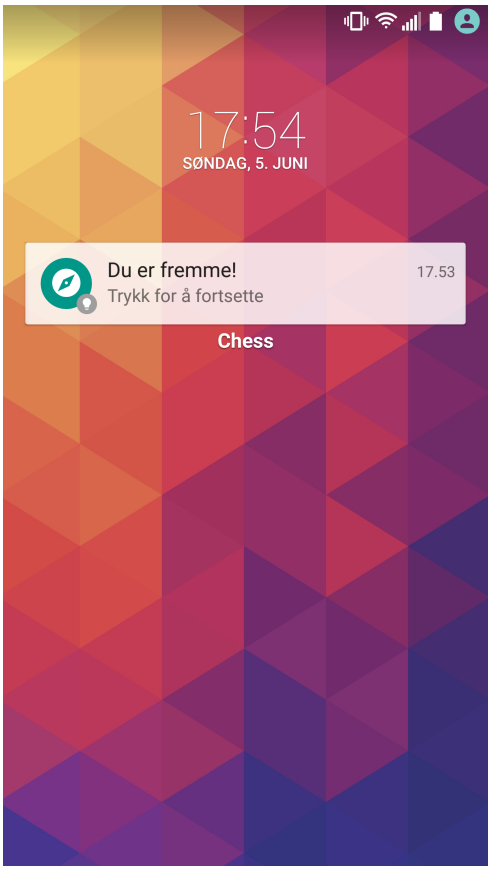


Figure 4.17: Notification received if task is found while the app is closed

The second task presents a number of statements, and she is to select on a scale to what degree she agrees or disagrees with the statements. After posting her answers another route description appear. This time she feels certain where to go, so she locks her smartphone, puts it in her pocket and starts to walk. When she now arrives close to third task, the smartphone vibrates as usual, but also shows a notification on the lock screen informing her that she has arrived. She then opens the app again and can continue with the third task.

The rest of the survey continues like this for a total of seven tasks. Types of tasks also included one where she was asked a number of questions with alternatives, and was only allowed to select one alternative per question, and one type where she could type some text as the answer. When the last task has been posted, Emma is taken back to the project view.

4.2.4 Discuss suggestions

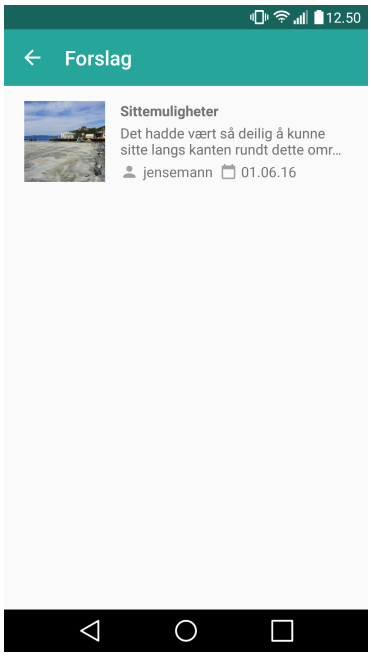


Figure 4.18: List of suggestions

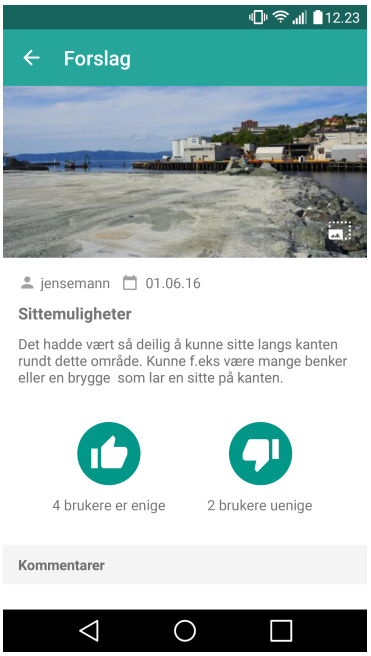


Figure 4.19: Viewing a suggestion

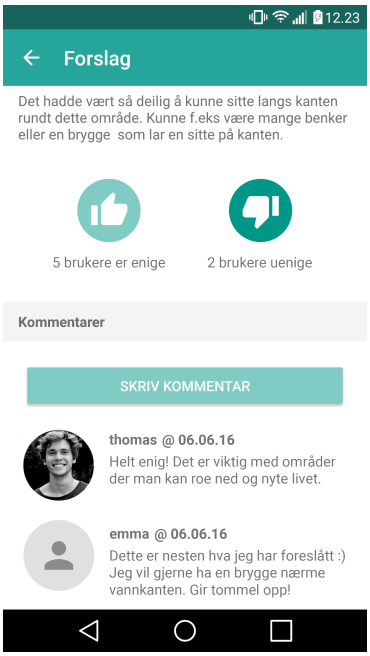


Figure 4.20: Comments below suggestion

After completing the survey Emma sees that someone has posted a suggestion, and she takes some time to read what is says. The suggestion is about having places to sit, either as benches or as a long dock. She agrees and touches the button with a thumbs up, and writes a comment saying that she would prefer a dock close to sea level.

4.2.5 Post suggestions

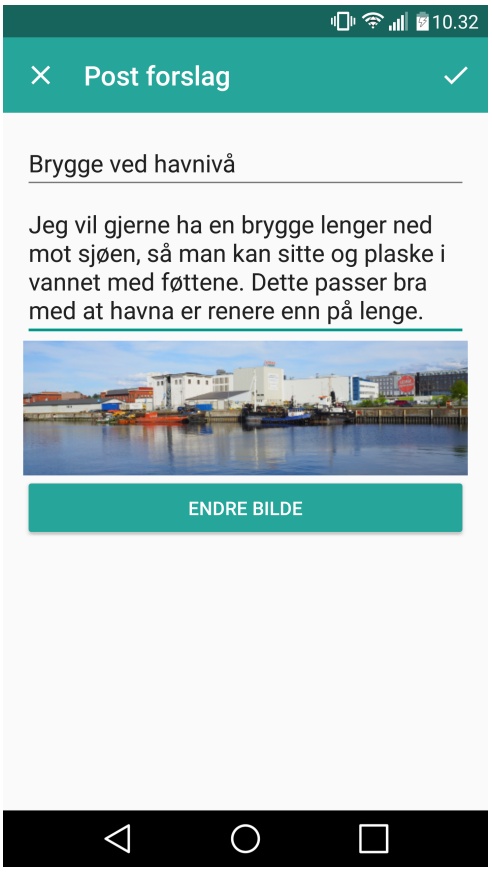


Figure 4.21: Posting a suggestion

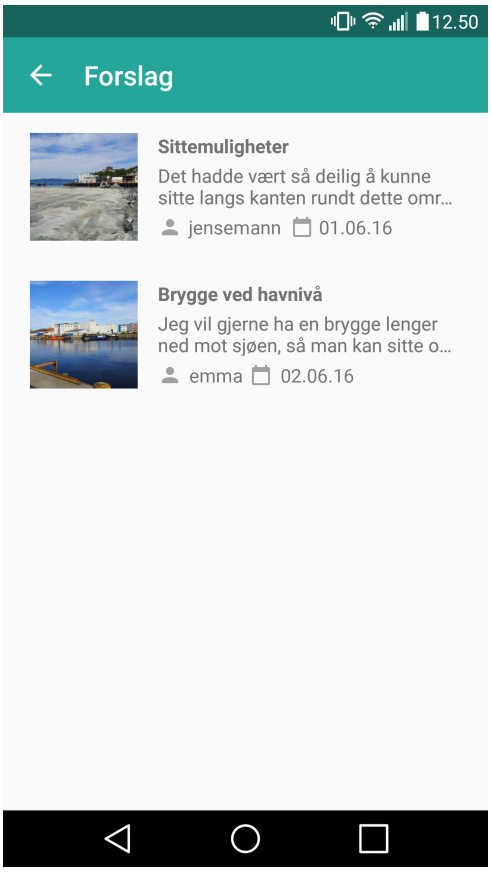


Figure 4.22: Posted suggestion in list

After completing the survey Emma knows more about Nyhavna than before, and has seen many new places. While taking the survey she walked along the harbor area wished to get closer to the water, but this was not possible. After the survey she therefore decides to post a suggestion regarding this. She goes back to that area and comes up with the idea of having a dock close to sea level, so people can come in contact with the water. She posts this suggestion and adds a picture of how the area looks now, which also makes it clear which area the suggestion is referring to. She can take the picture without closing the app. When she touches the check mark in the top-right corner the suggestion is posted, and a list of all suggestions posted to the Nyhavna project is opened.

4.2.6 Get rewarded

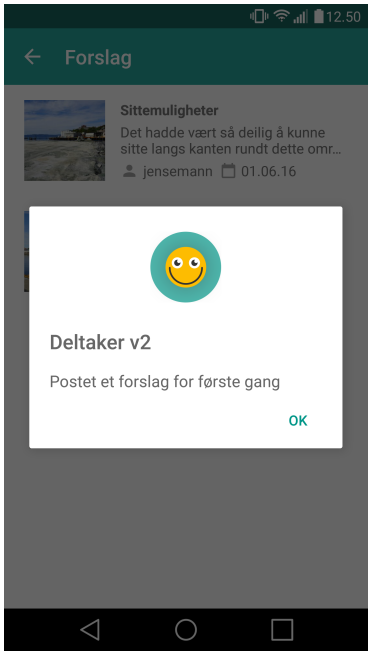


Figure 4.23:
Receiving an achievement

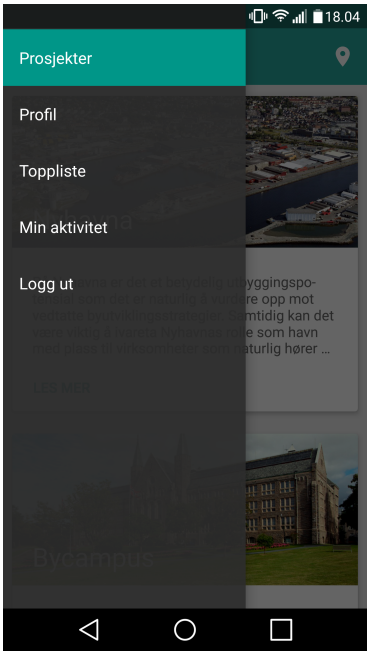


Figure 4.24:
The main menu

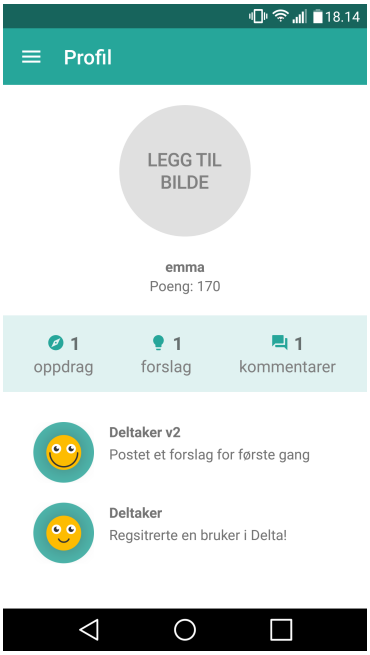


Figure 4.25:
The profile view

Emma received an achievement for posting her first suggestion. A dialog appears with a badge, achievement title and text describing how is was achieved. Emma decides to check out her profile. To get there she navigates back to the main view, opens the menu and selects 'Profile'. The profile shows the score, number of completed surveys, suggestions and comments, as well as a list of all achievements received.

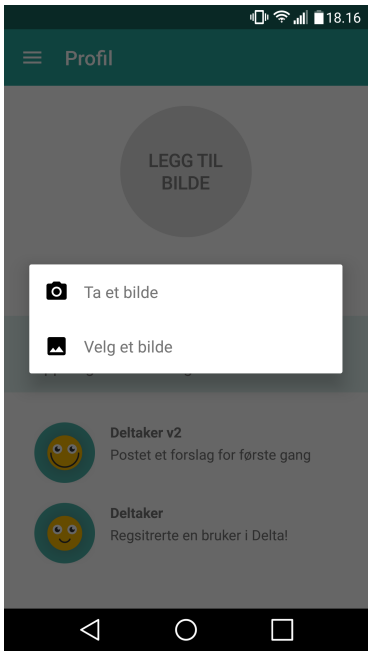


Figure 4.26: Choose to take a picture or select an existing one

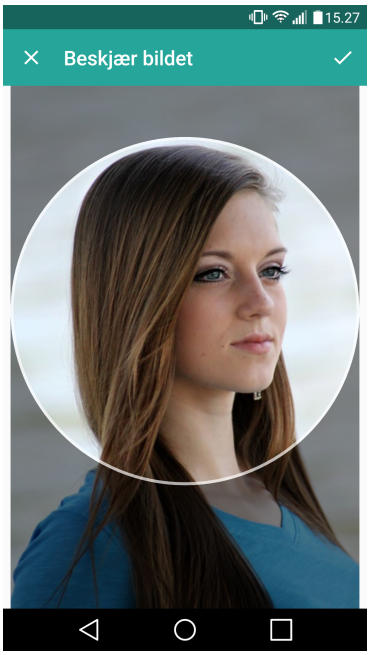


Figure 4.27: Cropping the picture into a circle

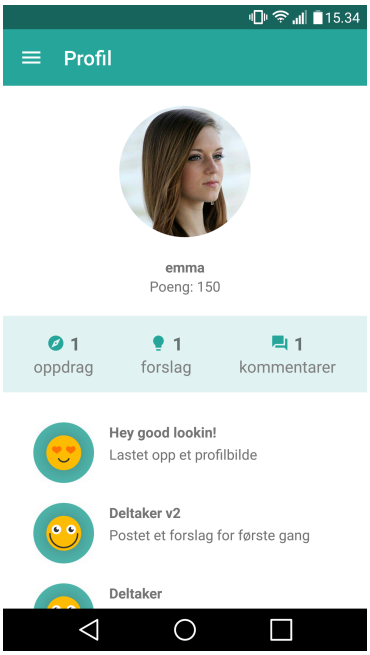


Figure 4.28: The profile view with profile picture

There is no profile picture yet, so she decides to add one by touching the empty profile picture which says 'Add picture'. Profile pictures can be uploaded by taking a picture, or selecting one from the picture gallery on the smartphone. The profile picture is always displayed as a circle in the app, so a tool helps to crop the picture correctly. The profile picture is also displayed next to comments and in the top list.

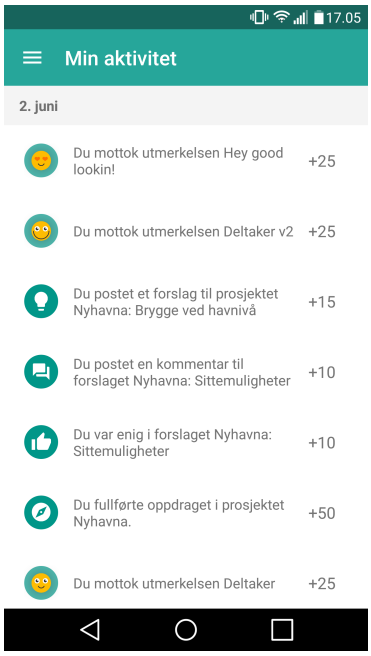


Figure 4.29: The activity log view

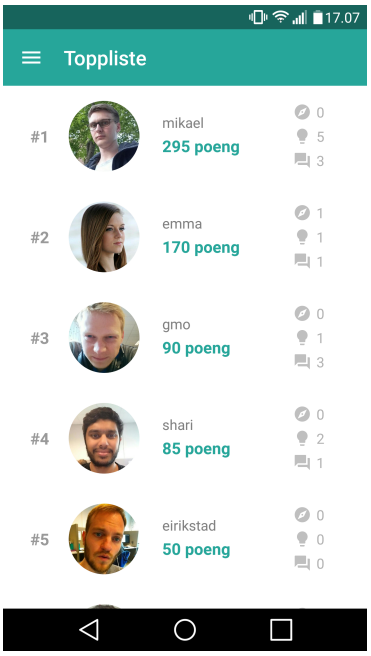


Figure 4.30: The list of users with highest score

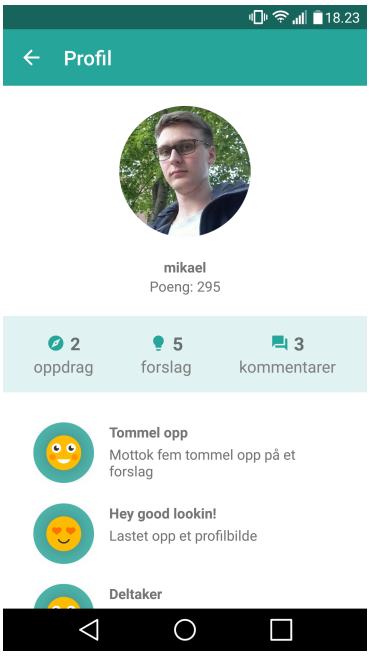


Figure 4.31: The profile page of another user

To get an overview of what she has done so far, Emma opens the activity log from the menu. The activity log lists all activities that a user has done within the app. Data per activity includes date, description and how many points the activity generated. Each activity also has an icon so they can be easily separated. Emma is proud of her contribution and the rewards she has received. To see how she is doing compared to the other users she opens the top list. Here the users are listed sorted on their score, and some statistics about their contribution is also included. Emma is delighted to see herself among the top users. By tapping items in the list the profile page for that user is shown.

The prototype has now been thoroughly presented, and the following chapter presents the underlying architecture and technology.

5 Architecture and technology

5.1 Three-tier architecture

The overall architecture of the system is a three-tier architecture, illustrated in Figure 5.1. This is a variant of the client-server architecture [33], meaning there is a central server that provides resources, and several clients that requests these resources. The system is divided into three tiers that are separated from each other, hence the name of the architecture. The layers are: data store tier, logic tier and client tier.

The data store tier is responsible for the persistence of resources. The client tier is the app, which presents data to the end user in a meaningful way. The logic tier works as an intermediary between the two other layers. It provides the client with a public API to access resources from the data store. Calls are sent from the client to the server via HTTP requests. In the logic tier, the request is mapped to a controller which performs the necessary actions. For POST-requests this could be to take the data retrieved and transform it into an entity object, store it, and return the result of the request to the client. For GET-requests it will typically query the data store tier for some resources, and transform and return the resources to the client.

The resources can only be accessed by the client via the API, and hence the resources in the data store tier are not directly exposed. This is wanted behaviour, since not all data is relevant or appropriate to send to the client. One example is if a client requests a specific user, we clearly do not want to return all information about this user, including the password hash. Another reason why resources are not directly accessible from the client is that the client and the data store have different purposes. While the client takes data and displays it to the end user in a meaningful way, the model in the data store is designed to support the business logic of the system. Therefore it is not always the case that it makes sense for the client to retrieve a single

resource from the data store as it is. The logic tier is responsible for querying the data store, and if necessary compose an object from several resources that fits the need of the client. The objects composed are called data transfer objects (DTO) and works as an interface between the client tier and the logic tier. Similarly, data access objects (DAO) are interfaces between the logic tier and the data store tier.

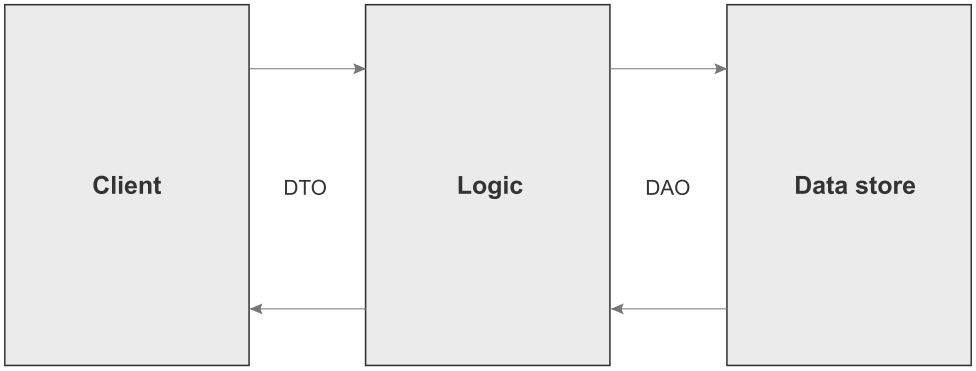


Figure 5.1: Overall system architecture

5.2 Model

The data model of the system is represented by Figure 5.3. Some details have been hidden for clarity.

5.3 Model-view-presenter

The app uses an architectural pattern called model-view-presenter. The main goal of this pattern is to separate user interface, logic and data. The model represents the data that will be shown. The presenter retrieves data from the model, formats it, and displays the data in the view. The view knows how data should be displayed, and also forwards events like clicks to the presenter, which knows how to handle the events. To retrieve data from the server, the presenter uses interactors that make asynchronous calls to the API, and gets notified about the result. Figure 5.2 illustrates how the components relate to each other.

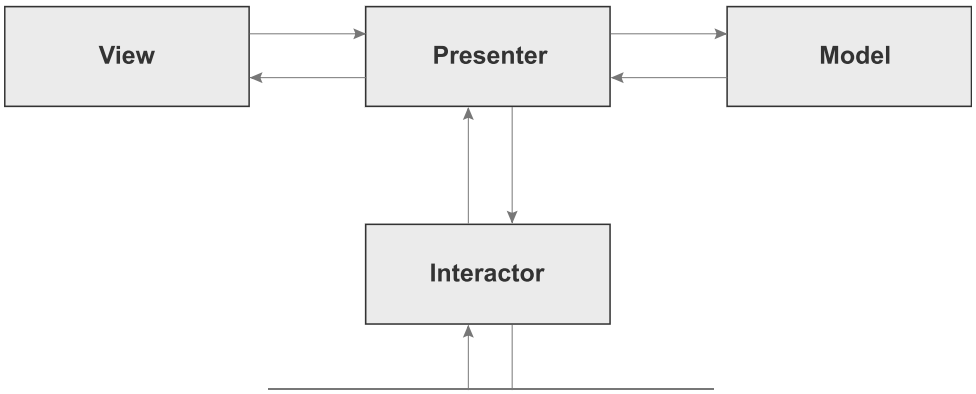


Figure 5.2: Client architecture

5.4 Implementation

The prototype was developed for the Android operating system. This was preferred mainly because it seems to be the least restrictive platform in terms of installation on test devices. It is also the platform I have the most recent experience with, so it allowed me to implement the prototype relatively quickly.

The API is implemented as a REST API using the Spring Framework. Spring was used since it is a well recognized framework, and provides many useful tools for making web services. Hibernate is used for persistence. This is a framework that maps a relational database to an object-oriented model. This simplifies the logic for storing and retrieving data, since everything is done on object-level. The underlying relational database used is a PostgreSQL database, but because Hibernate is used this could have been changed without having to rewrite code.

Mapped unto Figure 5.1, Spring will be the logic tier, PostgreSQL the data store tier, and Hibernate the interface between the two – the objects created by Hibernate being the data access objects.

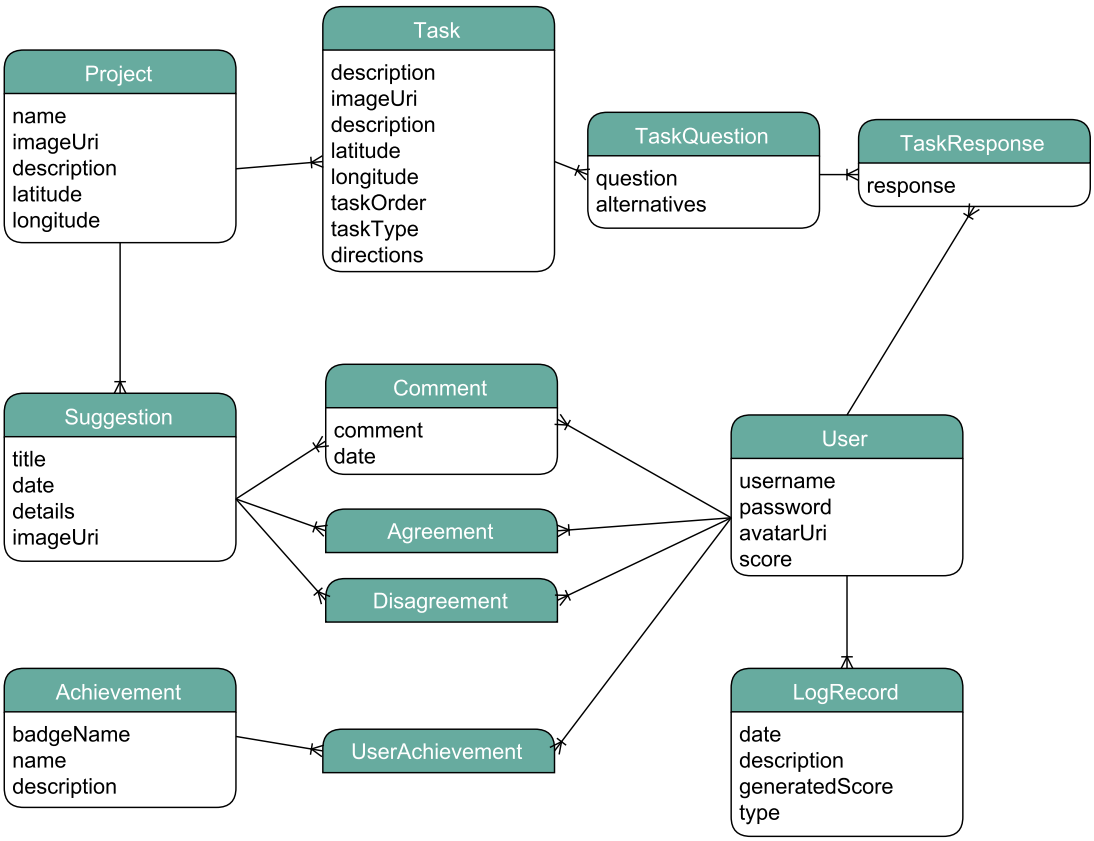


Figure 5.3: Data model

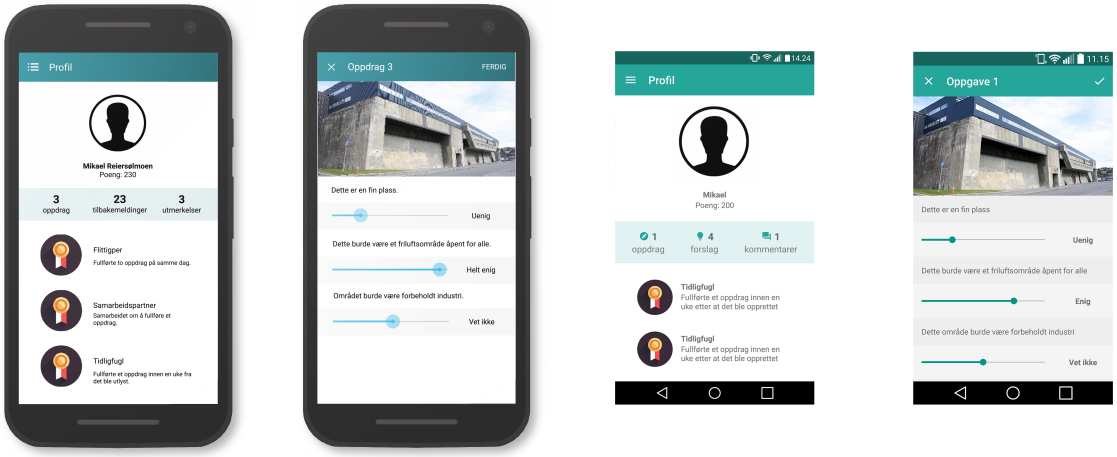
6 First iteration

The first iteration of the app development was the definition of the concept and creation of a low fidelity prototype.

6.1 Design process

The idea of an app with location-based surveys, designed to remind of a treasure hunt, was the starting point of the design process. This idea was mostly inspired by the concept of walkshops, as described in Chapter 2, combined with location-based surveys as in FlashPoll [29] and Tienoo [30]. To start thinking about how how such an app should work I used an online diagram tool[1] to sketch some of my ideas. The tool had predefined building blocks that allowed for rapid prototyping of the user interface of the app. The tool also allowed to view the prototype on a smartphone and simulate navigation between the views. The initial idea was to present such a prototype in expert-interviews to evaluate the concept, but I was not satisfied with the limited interaction. Since I have previous experience with implementing native user interfaces for Android, I decided to use the first prototype as a blueprint and implement a native prototype for the evaluation. In addition to the added interactivity, the fact that some of it might be reused in the next iteration of the prototype was important for making this decision. Figure 6.1 shows some examples from the two prototypes.

[1] www.lucidchart.com



(a) Wireframe profile (b) Wireframe task (c) Native profile (d) Native task

Figure 6.1: Examples from first and second prototype

6.2 Prototype

At the end of the first iteration the result was an app without functionality. It was possible to navigate to the different views in the app, but the content was static and only for the purpose of presenting the concept.

These views existed:

- A map with projects placed as pins
- Project pages
- A map with tasks placed as pins
- Scale tasks
- Free text tasks
- Write a suggestion
- List of suggestions
- Write a comment
- Detailed suggestion page
- Profile page
- Top list
- Activity log

Apart from content and functionality, the views listed above looked for the most part similar to

the view presented in Chapter 4.

6.3 Evaluation: interviews

The evaluation of the first iteration consisted of three semi-structured interviews, evaluating the concept by gathering qualitative data. The interview protocol can be found in Appendix A. The main goal of the interviews was to present the concept, and get feedback regarding its potential. This way the interviews were intended to evaluate if the concept was worth continuing to work on, and gather ideas that could help to further develop and refine the concept. Semi-structured interviews were chosen to let the interviewees engage in topics of their interest in order to benefit from their expertise, while at the same time covering certain topics. This was appropriate since the goal was not to collect vast number of data for generalization, but in-depth data on personal impressions.

6.3.1 Choosing interview targets

Table 6.1: Overview of interview targets

ID	Age	Gender	Expert
F1	15	Female	Youth city council member
F2	28	Female	Architect / Research Assistant
M1	44	Male	Architect / Associate Professor
M2	45	Male	Children's Representative in Trondheim

The first interview was held with a 15-year old girl. This person was chosen to get an evaluation from someone who represents the end user of the app. Some questions in the protocol hence resolved around how the interviewee imagined it would be to use such an app, which part that would be most motivating, and the perceived value of situatedness. She is also a member of the youth city council in her municipality, and therefore has insight into one of the ways youth in Norway get involved in planning today, as youth city councils exist in many Norwegian municipalities. This background would enable discussion of how the involvement offered in the app concept compares to involvement in a council.

The second interview was with an Associate Professor and a Research Assistant, both from the

Faculty of Architect and Fine Art at the Norwegian University of Science and Technology. With their expertise in urban planning the idea was that they would provide valuable input to how the concept is from a planners perspective. How likely the concept would be to work in a real-world scenario, challenges from a planner's point of view, possibilities of data collection through a treasure hunt, and usefulness of open suggestions from youth were some topics of particular interest for this interview. From earlier meetings with the interviewees, it was also known that they work in the field of user involvement in planning, and strengthened the motivation for including them in the first evaluation.

The third and final interview was held with an employee in the municipality of Trondheim, who works with the involvement of children and youth in planning processes. An evaluation of the concept by a person with a solid insight into the topic of children's participation was thought to be very valuable. Many of the topics seeking to cover with this interview were similar to the second, but with more focus on how the concept might fit into current practices in the municipality.

6.3.2 How interviews were conducted

Three slightly different protocols were made for each interview. The same structure was set for all the interviews, but the questions were somewhat different. While the questions in the last two interviews were nearly the same, the questions for the youth council member differed more. The interviews were held in an informal manner, and questions could deviate from the protocol when appropriate. Each interview started with some casual conversation. The context of the work, and the goal of the interviews was explained. Then the interviewee was given a short presentation of the concept. The survey functionality was in focus here, as it arguably is the main functionality, and the part of the concept that is most challenging to explain properly. This functionality was hence demonstrated with pictures of a low-fidelity prototype put into context, showing a person move around while taking a survey.

Figure 6.2: Some of the pictures used to present the survey functionality of the concept.

The interviews went on differently after this point. In one instance, the interviewee immediately had something to say about the survey functionality as it was being presented. Questions from the protocol regarding this were consequently brought up and discussed. Then the rest of the functionality was presented, and further questions were asked, along with the interviewee testing the prototype. In another instance all the functionality was presented before any feedback was given. Feedback continued both meanwhile and after the prototype was shown. In the final instance the whole concept was presented, and the prototype shown, before the questions from the protocol were brought up.

6.3.3 Data extraction

The interviews were audio recorded. This enabled the interviewer to focus entirely on what was being said, and stay alert to try and bring up questions from the protocol whenever appropriate. As the interviews were conducted by one person only, taking notes would not have been enough to capture the responses in enough detail. The audio recordings were afterwards used to make transcripts of what was said during the interviews. Only the relevant parts were transcribed, and not written as direct quotes, but as simple as possible without loosing its original meaning. Writing the transcriptions was a good reminder of what was said during the interviews, and worked as the basis for extracting and summarizing the results.

The transcript of the interview with the architect professor and research assistant revealed that the enthusiasm for the concept lead to the interviewer forgetting to ask important clarifying questions. Instead much of the conversation resolved around the possibilities of the concept being realized. The interviewees could for instance repeat how good the concept was, and the interviewer would forget to ask for an explanation of what makes the concept good. To resolve this, some follow-up questions were sent via email two days after the interview took place. Clarifications and some more details were sent back the same day. This response has been added to the results.

6.3.4 Interview results

This section summarizes the most relevant things that were said. The summaries are not structured based on the interview protocol, but tries to represent the flow of the interviews. The results will be discussed in the next chapter.

Youth city council member

F1 was immediately positive towards the concept. She knew people who had opinions about everything, and she knew they would have liked the app, since they could share ideas with each other. Having full names attached to suggestions and comments was not seen as a problem, since people are already used to social media. She thought the app would be easier for planners to use, compared to meeting people in specific places, like the youth city council, and also saw that the concept would allow even more people to participate, not only those who actively engage in committees. She thought it would be especially interesting for those who lived close to the location of treasure hunts. Asked about her favorite functionality of the concept, the ability to comment peoples suggestions was brought up. This was because it would make it easier to understand different viewpoints, and perhaps bring attention to details that might change a persons opinion about something. The ability to see the location of projects on a map and read about them was a good thing, as it is hard to keep track of what is happening and where. She thought it was a good idea that one have to go to the actual locations, since maps easily can be misinterpreted, and then the starting point for providing feedback is wrong. Asked whether or not she thought youth would perform such treasure hunts on their own initiative, the answer was yes, as long as they were interested in what was going on, and that the probability would be higher when the location is close to their home.

Children's representative in Trondheim

M2 immediately reflected on how the concept differs from how things often are done today. Often when planners have ideas and want feedback from young people they have a presentation prepared, and show it to a group. In this concept the youth have to actively go out, and he said it might be easier for the youth to provide feedback when they physically see something. Before the concept was presented, M2 talked about another tool the municipality had used to collect opinions from children, which he had been involved in. This is called Barnetråkk[2], and involves the children using a website to mark places that they use and express how they feel about them, for instance their way to school or places where they play. These activities would typically occur in an organized setting at school, where children were taught to use the tool. After the concept was presented, M2 reflected on how these tools were different. The differences were that this concept was connected to specific planning projects, and would also give planner the opportunity to present something. He also thought such a mobile solution could be easier to use, since the organizers do not need to provide a certain number of computers. And the fact that the participants do not need to sit in a room he thought would be positive, especially for youth. Discussing the notion of being situated, he thought this would be a strength when a planning project is at a place where people normally do not go. An industrial area in Trondheim, Nyhavna, was used as an example. When people then move around this area they would be able to say something about its potential and how it could be made more attractive. If the system should be open for everyone to use, meaning that every user can give feedback to all the active projects in the system, he saw the challenge of filtering out inappropriate suggestions and comments. He suggested that the planners should be able to control whether or not a project is open for everyone, and imagined that planners might wanted to have a briefing with the participants before a treasure hunt, and in this context provide the participants with a password to unlock a project in the app. The openness of projects depended on the nature of the projects and what the planners wished to achieve with the participation. He was unsure whether or not a treasure hunt would make sense without some sort of briefing before going out. He imagined that such a briefing could be held in a school class, and that the pupils would think it was fun to compare their scores at the end of the day. Towards the end he concluded that it would be exciting to test such a concept, as it was something different from what already exists. Overall he thought it was a good idea and a tool that ”can be valuable regarding children and youth's influence”.

[2]http://www.barnetraakk.no

Architects

After being presented the concept, focusing on the mobile application, M1 immediately asked about an interface for the planner, and stressed that this was an important part of the concept if it was to be realized. It should be easy to add new projects and tasks, and the survey responses, suggestions and comments should appear in the same interface. F2 agreed that it would be nice if the user interface for planner was as easy as for the mobile application.

The treasure hunt was seen as something interesting and innovative, since it was engaging and responses are collected immediately, and not delayed in a survey. The fact that participants have to move around could be a way for participants to gain new perspectives, and hence increase the feedback's quality. The detail that participants have to navigate using their surroundings, and not only an interactive map was something positive. As a planner, M1 also liked the ability to design a treasure hunt with a route and tasks.

M1 expressed some concern regarding the motivation for using the app, and whether or not the game elements were enough to engage, or if there had to be added another layer of reward. This did not have to be something inside the app, but could be something physical, possibly in the form of physical rewards along the treasure hunt. Another important factor in this regard was that the participation should mean something: "I think it is important that it [using the app] is not just an exercise, but that it means something". F2 added that the app could be used in a classroom setting, for instance when planning the school area, and that a winner could be announced with the score system. The planner could then adjust the tasks according to the context. The threshold for youth downloading the app and using it on their own initiative were seen as somewhat higher. Concrete projects at schools in the Trondheim area were mentioned as potential places to test such an approach.

Two suggestions for how to improve the concept came up. One was to make tasks in treasure hunts be like small games, to make it more fun for those who are not so interested in urban planning. However, no concrete ideas for what such a game could look like came up. Another idea was to let people draw on top of the pictures added to suggestions, which should be especially fun for the younger users.

Asked whether or not the suggestions made in the app would have any impact, they were compared to public consultations today, where zonings are made public, and all people should have the opportunity to respond. A suggestion in the app could be imaged to be such a response. The challenge, however, would be how to take suggestions into formal contexts, and how to avoid creating false expectations. Another challenge would be how to handle contributions that are

not serious.

6.4 Discussion

As interviews were held with a small number of people, the results should not be used blindly to support the concept. However, taking into account the expertise and relevance of the interview targets, the results from the interviews strengthen belief in the concept, and has certainly motivated the author to continue the work. The main goal of the interviews was to do a reality check on the concept and its potential, and gather feedback that could help to further develop and refine the concept.

Feedback on the situated engagement was very positive, and some of the effects the interviewees perceived this approach would bring aligned well with statements argued for in the design rationale. To sum up, it was believed that it would be easier for youth to provide feedback when they physically see something, and especially when planning at places where people normally do not go. This aligns with the feedback that maps can be misinterpreted, and give feedback a wrong starting point. Consequently this was believed to increase the quality of the feedback. It was also suggested that situated engagement fit youth especially well, compared to ”just sitting in a room”.

Most interviewees were not convinced that the app could be immediately released and promote participation by youth downloading and starting to use the app on their own initiative. The suggestion was that the app first could be used in a school class, where the project would be presented, and that the pupils afterwards could go and do the treasure hunt. The project would only be open for these participants, but they still thought the gamification part would be meaningful, as it would be fun for the pupils to compete among themselves. A challenge with this approach, deploying the app for a short time in a certain context, is that it might not give enough time for the reward system to reach its full potential, which requires users to post suggestions and interact with them. But if the participants truly find the app engaging, one can image that some will continue to use the app also when the organized event is over. It was also suggested that the app could be deployed during events at the planning site. The same questions of how the game elements would work, and how engagement would continue after the event, are relevant also in this case.

It hence remains unknown whether or not the app can work as a stand-alone solution for engagement in urban planning, but deploying the app in a more closed setting could be a good starting point for testing whether or not it is engaging enough to motivate further participation. If it would work to make the app public, and projects made open so everyone could respond to them, it would have the potential to involve a larger number of people. The question is whether or not the app is engaging enough in itself, or if there needs to be another layer of reward, a question brought up by the associate professor. It also comes down to whether or not planners would be able to gather enough good data. Opening the app for everyone would probably attract frivolous and inappropriate contributions, which would have to be filtered out.

7 Second iteration

7.1 Design process

At this point in the process, the app had already been designed, except it lacked functionality. The positive feedback from the expert evaluation meant that I could go on with the implementation of the app for further testing. Since the user interface was already made, and the functionality already decided, this process was a matter of creating the web service that the app could use to retrieve and store resources, and replace the static data in the prototype with data from the service. This explanation is a bit simplified, but worked as a way to structure my work and focus on what was important.

To make the prototype functional took a lot of hard work, but was in a sense not a part of the design process, since the design did not change. However, a short evaluation took place right after the functional prototype was ready, and before the usability test. A protocol had been written for the upcoming usability test, and a pilot test was run to evaluate the protocol and the prototype itself.

The pilot test uncovered two main issues. Firstly, when the app was opened, and the map with pins (representing projects) appeared, it was not clear that one was supposed to touch the pins to read about the projects. It was also requested that it should be possible to view the projects in a list. Secondly, this map and the map inside a survey used the same pins, which caused confusion about the connection between these maps. To fix the first issue, I implemented a list view for the projects and made it the default view when opening the app. The list was relatively detailed, with a picture, text and a button to read more and open a project page. The button was added to make it explicit for the user what actions can be done.

To fix the second issue and make sure that the two map views are understood as separate views, I created custom pins for each map. Projects are viewed on the map as pins with a light bulb inside, and tasks are shown as pins with a number inside. The number indicates the order of the tasks.

7.2 Prototype

The following list is the functionality that was implemented as part of the user interface that was already defined in the first iteration:

- The user can see the locations of projects on a map
- The user can read more information about each project
- The user can take surveys with two type of tasks: linear scale and free text
- The user can browse suggestions
- The user can read more details about each suggestion
- The user can agree or disagree with suggestions
- The user can comment suggestions
- The user can post suggestions
- The user can upload a picture to their profile page
- The user can see a list of the users with the highest score
- The user can see a list of all their activities in the app

Additionally, this functionality was added:

- The user can registering in the app
- The user can log into the app
- The user can show projects in a list

7.3 Evaluation: usability test

This section describes how the functional prototype was evaluated by running a usability test. The protocol for the usability test can be found in Appendix B. The main intention of the test was to evaluate the usability of the prototype, but was also the first time it was thoroughly tested outside, and hence also gave insight into how it might work in a real scenario.

7.3.1 How the usability test was conducted

The usability test was run with five students at the university, from three different studies. By picking students for the evaluation, the recruitment process was simplified, and the participants were not far from the age of the target group. It could also be argued that youth and people in their early twenties have more or less the same prerequisites when it comes to usability of apps.

The test was structured in four steps:

- Consent
- Presentation of concept
- Tasks
- Questionnaire

Consent

Before the test started the participant was asked to read and sign a consent form that explained their involvement, what data that would be collected, and how the data would be used.

Concept presentation

Before starting the tasks, the participant was given a short presentation of the concept. This was made short and only gave a brief explanation of what the app is for. The intention of this was to not give away too much information that would make the tasks easier, which would undermine the goal of testing the usability of the app.

Tasks

The main part of the evaluation was a set of tasks each participant had to complete, reported in Appendix B. The tasks went through all the functionalities of the app one step at a time, which at the end should give the participants a good perception of the usability. The participants were encouraged to speak their mind while performing the tasks, and come with suggestions or explain how they expected the app to work. The most comprehensive task was to complete a treasure hunt. For this task a treasure hunt around the campus was defined. The treasure hunt consisted of five locations in addition to a starting point, with new tasks to finish at each location.

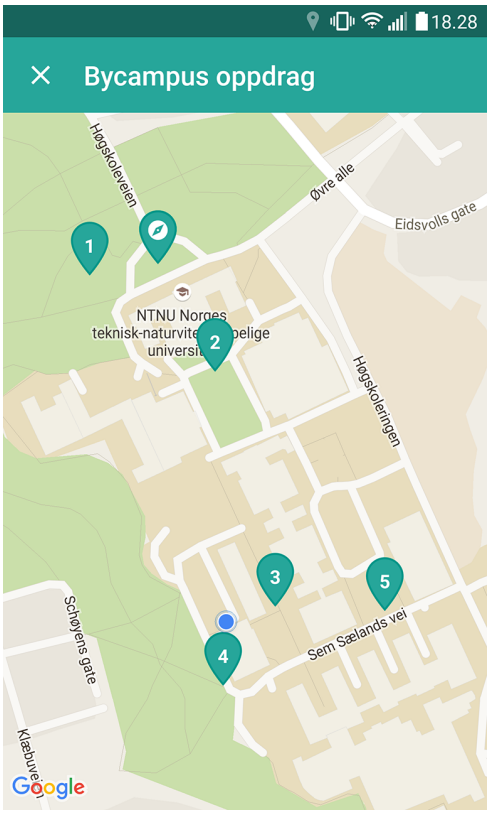


Figure 7.1: The treasure hunt defined for the test

The participants were only told to find the campus project in the app and complete the treasure hunt, and from there on follow the instructions in the app. The description of how to get from the starting point to the first location was somewhat ambiguous, so in some cases the participant was helped in the right direction. After the treasure hunt was completed, participants were given tasks such as posting a suggestion, find the profile page, and express opinions about suggestions already posted. Eventually the participants had been introduced to all the functionalities of the app. Afterwards they were free to continue interacting with the app as they liked. In some cases the participant actually started the next task before it was given to them, and in these cases they

were not interrupted. This happened for instance when the next task was to register a user and log in, or post a suggestion after completing the treasure hunt.

Figure 7.2: Images from the usability test

Questionnaire

The last step was to let the participants take a short questionnaire about their perceived usability of the app. The System Usability Scale was chosen since it short, free to use, and works well with a small sample size [34].

Table 7.1: The questionnaire of the System Usability Scale.

#	Question
1	I think that I would like to use this system
2	I found the system unnecessarily complex
3	I thought the system was easy to use
4	I think that I would need the support of a technical person to be able to use this system
5	I found the various functions in this system were well integrated
6	I thought there was too much inconsistency in this system
7	I would imagine that most people would learn to use this system very quickly
8	I found the system very cumbersome to use
9	I felt very comfortable using the system
10	I needed to learn a lot of things before I could get going with this system

7.3.2 Data extraction

The usability test was documented in several ways. While undertaking the treasure hunt, participants were equipped with a camera mounted on their head. The camera had a wide angle lens, allowing it to capture how the participants interacted with the smartphone and the environment. It did not, however, manage to capture in detail how participants interacted with the app. For this the screen of the smartphone was recorded with an indicator showing every touch on the screen. Additionally, the author followed the participants to observe and note if anything particular interesting occurred. Any comments or suggestions made by the participants were also noted.

Figure 7.3:
Participant interacting with the environment

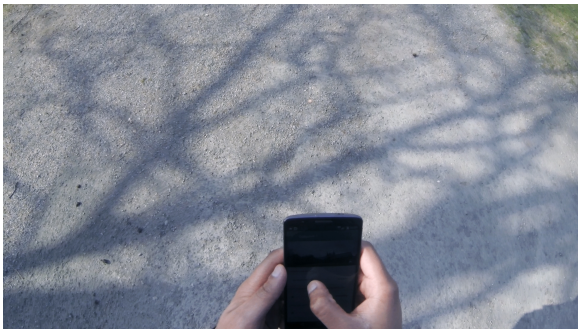


Figure 7.4:
Participant interacting with the smartphone

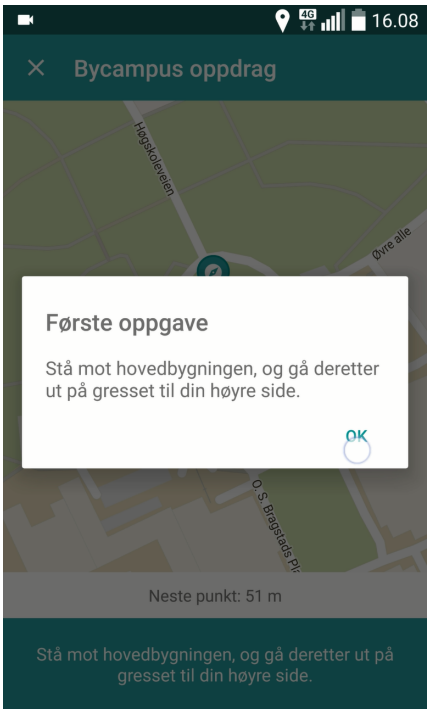


Figure 7.5: A dot indicated touches during the test

The screen recordings along with notes taken were the most important data sources. The screen recordings were thoroughly analyzed and all exceptions were noted. Exceptions in this case were touches that had no functionality, touches that were thought to do something else, and unintended touches. Interesting things the participant said during the test were digitalized and coded as either a comment or suggestion. The footage from the head-mounted camera was used to extract these metrics for each treasure hunt session:

- Total time spent on the treasure hunt task
- Time spent finding locations
- Time spent answering tasks
- Time spent interacting with the app
- Time spent interacting with the environment

Whether the participant was interacting with the app or the environment was determined by the angle of the footage, as the head is normally tilted downwards when interacting with the app. Figure 7.3 and 7.4 show footage from when a participant is standing still answering a task during the treasure hunt. The pictures clearly show the distinction between interaction with the app and the environment.

7.3.3 Usability test results

Usability problems and error

Usability problems are problems participants encountered while testing the app. Generally such problems could be that the user does not know what to do next to complete a task, or have difficulty doing so. It could also be that the system does not work the way the user expects it to, which was the case for all the usability problems encountered during this usability test. The table below lists the problems: what action the user took, what the user expected the action to do, and how many participants encountered the problem. Instead of doing what was expected, all except one of the actions did nothing at all, and in all cases the participant still managed to complete the given task, hence the severity of all the usability problems were rated as low.

Table 7.2: Usability problems

#	Action	Intention	Occurrences
1	Touched the username in a suggestion	Go to profile	1
2	Touched the picture in project list	Go to project	3
3	Swiped from left to right on screen	Navigate back to the previous view	1
4	Touched picture uploaded to new suggestion	Take a second look at the picture	1
5	Touched the text in the first task	Start the mission	3
6	Clicked enter (new line) on keyboard	Submit task	2
7	Touched a list item in top list	Go to profile	1
8	Touched a profile picture in comments	Go to profile	1

Errors are unintended or wrong actions the user makes while doing a task. These errors were more severe than the usability problems listed above, since they resulted in an unwanted state. The level of severity was decided based on the implications of the error and how easily the user could recover.

Table 7.3: Usability errors

#	Error	Occurrences	Severity	Comment
1	Submitted a task response by mistake	1	High	Task response could not be undone or changed. Can compromise the quality of data collected.
2	Closed informative dialog by mistake	1	Medium	Might confuse the user of what to do next. Possible to bring the dialog back up. Could be made harder to close by mistake.
3	Tried to register user by logging in	1	Low	A message will say that the username or password is wrong. Should prompt the user to look for register button. Register button could be made more visible.

Interaction during treasure hunt

The video recordings from the camera mounted on the head provided information about how the participants interacted with the app and the environment. Figure 7.6 shows the average time distribution between answering tasks and finding the next task. Figure 7.7 shows how the time spent answering tasks and finding the next location is divided between interaction with the app and interaction with the environment. Table 7.4 summarizes the data that was extracted from the footage and is the foundation of the figures.

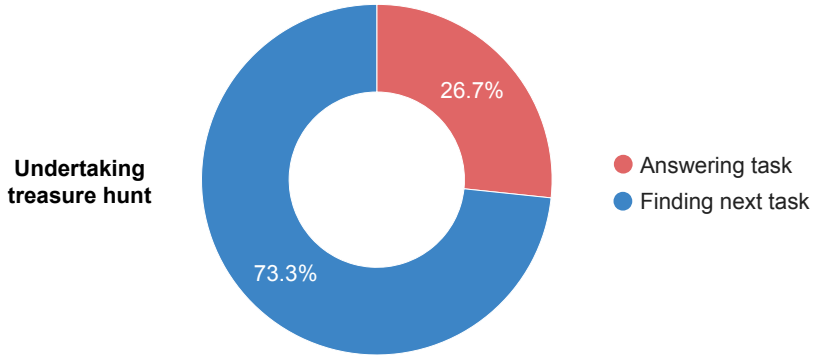


Figure 7.6: Average time distribution during treasure hunt

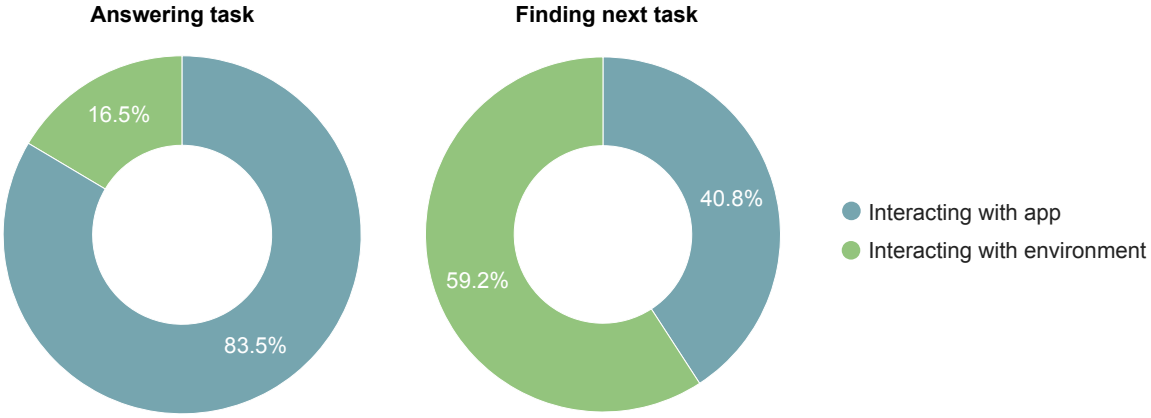


Figure 7.7: Average time distribution when answering task and finding the next task

Table 7.4: Data extracted from video footage of the treasure hunt

	Time spent answering task		Time spent finding next task	
Participant	App interaction	Env. interaction	App interaction	Env. interaction
1	05:53	00:47	00:42	06:09
2	01:37	00:11	04:23	04:26
3	02:05	01:08	05:42	04:48
4	02:32	00:40	04:19	07:29
5	02:26	00:06	04:28	05:29

Suggestions and comments

Table 7.5: Suggestions that came up during the usability test

#	Suggestion
1	Scale tasks should have a description of what to do, e.g. “select your response to the following statements”.
2	It should be able to post a suggestion from the list of suggestions, e.g. a button in top-right corner.
3	Instead of showing the number of agreements/disagreements, the text below thumb up/down buttons could show a text “click to agree”, “click to disagree” and if one is pressed, the numbers could appear. This to make it clearer that the buttons are clickable.
4	A message should appear if a user is successfully registered.
5	A tutorial should give the user an introduction to the app.
6	Users should get points for uploading a profile picture.
7	The list of suggestions should show the number of thumbs up for each suggestion.
8	It should be able to post (task response, suggestion, comment) by touching bottom-right button on keyboard.
9	Log in page should indicate progress.
10	It should be able to sort suggestions on number of thumbs up.
11	It should be able to like comments and sort comments on number of likes.
12	It should be able to comment on comments.
13	When the drawer menu is open, the back button should close it.

Questionnaire result

Table 7.6 summarizes the response from the questionnaire the participants answered shortly after the usability test was over. The table shows how responses were distributed across the scale. Following the System Usability Scale Template [35], a SUS score of 93 was calculated.

Table 7.6: Results of the usability questionnaire.

1 = strongly disagree, 5 = strongly agree

#	Question	1	2	3	4	5
1	I think that I would like to use this system	-	-	-	0.6	0.4
2	I found the system unnecessarily complex	1	-	-	-	-
3	I thought the system was easy to use	-	-	-	0.6	0.4
4	I think that I would need the support of a technical person to be able to use this system	1	-	-	-	-
5	I found the various functions in this system were well integrated	-	-	-	0.2	0.8
6	I thought there was too much inconsistency in this system	1	-	-	-	-
7	I would imagine that most people would learn to use this system very quickly	-	-	-	0.6	0.4
8	I found the system very cumbersome to use	0.8	0.2	-	-	-
9	I felt very comfortable using the system	-	-	-	0.6	0.4
10	I needed to learn a lot of things before I could get going with this system	1	-	-	-	-

7.4 Discussion

7.4.1 Usability

The usability of the app can be drawn from three data sources: observations, screen recordings and questionnaire result. Firstly, the observation showed that the participants understood how to use the app after being briefly explained what the app is for, and that they managed to complete all the tasks without help from the observer. Secondly, by reviewing the screen recordings after the test it was confirmed that the tasks were correctly done. Thirdly, the questionnaire result indicates that the participants perceived the app as very usable, indicated by the calculated SUS score of 93. By analyzing nearly 1000 SUS scores, [36] found an adjective rating scale that correlates with the SUS scores. The adjective rating scale contains: worst imaginable, poor, OK, good, excellent, and best imaginable. With a SUS score of 93 the app received the highest adjective rating on this scale.

7.4.2 Interaction

Participants were equipped with a camera on their head, to capture their movements. This was to get a better understanding of how they interacted with the app and the environment. The data derived from this footage did not uncover any usability problems regarding the duality of interaction. It was not difficult for the participants to find the location of the tasks during the treasure hunt, so most of them interacted more with the environment than with the smartphone when navigating from one task to another. When answering tasks the distinction is even clearer, as most of the time went to interacting with the app. The little interaction with the environment could be explained by the relatively simple questions, and that all the participants know the area well. It is nevertheless positive that the participants also interacted with the environment to answer the tasks.

7.4.3 Problems and errors

During the test, none of the participants encountered usability problems that hindered them from completing a task. All but one of the usability problems recorded did not have any side effects. The exception was usability problem #6 that would enter a new line in the text area of a text task. Still none of the usability problems left the user in an unwanted state. Additionally,

the ability to go to a profile page by touching a list item in the top list (#7), or a profile picture in a comment (#8) had simply not yet been implemented in the prototype. Table 7.7 suggests how to handle the usability problems.

Three usability errors were recorded, with various degree of severity. I would argue that the one where a user cannot go back and change a response is the only one that is very serious, as a user should always be able to undo a wrong action. Table 7.8 suggests how the usability error should be handled.

Table 7.7: Usability problems fixes

#	Usability problem	Proposed fix	Rationale
1	Touched the username in a suggestion	Touch will open profile page	Good way to explore content in the app
2	Touched the picture in project list	Touch will open project page	Expected behavior by many participants
3	Swiped from left to right on screen	Nothing	Not standard way of navigating in Android
4	Touched picture uploaded to new suggestion	Nothing	Not necessary since whole picture is shown before uploading
5	Touched the text in the first task	Nothing	The first task will be replaced by a normal task, which will eliminate this problem
6	Clicked enter (new line) on keyboard	The enter button could be removed or replaced with a post button	Should avoid unwanted line shifts. Post functionality not critical.
7	Touched a list item in top list	Touch will open profile page	Good way to explore content in the app
8	Touched a profile picture in comments	Touch will open profile page	Good way to explore content in the app

Table 7.8: Usability errors fixes

#	Usability error	Proposed fix	Rationale
1	Submitted a task response by mistake	It should be possible to re-open a task as long as the user has not left the location of the task	This is a comprehensive fix, but how I think it should work. An easier fix would be to show a confirmation dialog before submitting, but this could be cumbersome for the user.
2	Closed informative dialog by mistake	Dialog can only be closed by hitting OK button	The dialog was closed by mistake by touching the screen outside of the dialog. By changing this behavior the mistake us unlikely to be made
3	Tried to register user by logging in	Make register button larger	If the user sees the register button right away the mistake can be avoided

8 Third iteration

8.1 Design process

The usability test confirmed that the prototype was usable, but there were still quite a few things that could be improved. There was not enough time to fix everything discovered in the usability test, so I prioritized problems and suggestions based on occurrences and complexity to fix or implement. The main goal of this design process was to make the prototype ready for the final field test, so I had to be pragmatic. The rest of this section summarizes the changes made to the prototype, and explains the process of creating a survey for the final evaluation.

8.1.1 Prototype changes

Table 8.1 summarizes the most notable changes made to the prototype. Change #1 was the most comprehensive, since it included new functionality and changes to the data model. This change was not a result of the usability test and will be further explained in the next subsection.

There was one usability error that was not fixed, despite its high severity. This was error #1 from Table 7.3, where a user could not go back and change a task response. This error could possibly reduce the validity of survey responses, but was not fixed since it would be comprehensive to fix, and the consequence of the error is not dramatic for testing purposes.

Table 8.1: Changes made to prototype after usability test

#	Change	Rationale
1	Surveys support two new type of tasks: multiple choice and checkboxes	Explained in next section
2	Users get achievements for certain activities	This was planned from the beginning, but not prioritized until the final iteration
3	Users get points for uploading a profile picture	Suggested during usability test
4	Profile pages can be opened by touching items in top list or profile pictures next to comments	Attempted several times during usability test
5	Touching a picture in the list of projects opens that project	Attempted several times during usability test
6	The button to change from project list view to map view was changed	Several participants noted that the icon was not very clear
7	If the main menu is open, pressing the back button on the smartphone will close it	Bug discovered by one of the participants

8.1.2 Creating a survey

The creation of a survey for the field test proved to be more challenging than anticipated. It did however give some insight into what it takes to create a survey, and it also helped to shape the concept.

A number of architects were involved to make relevant tasks for the survey. The concept was presented to them, but exactly what it involved to design a survey was not explicitly stated. Their contribution was a set of questions with alternatives. At that time the solution only supported two type of tasks: linear scale and text (see Figure 4.2), and hence the questions were not compatible. This was an interesting situation, especially since one of the questions in the expert interviews were if the interview target could think of any other type of tasks necessary to collect relevant data. In this sense the contribution from the architects worked as an evaluation of task types, and consequently two new task types were implemented: multiple choice and checkboxes.

Another challenge was that when the questions were mapped to specific places, some of the questions were far away from any other question, and it would be difficult to describe the path between them without using pins on the map. To solve this some of the more general questions not referring to a specific place were placed strategically to create a route without very long distances between each task.

After the tasks had been placed on the map, it was time to make descriptions of how to navigate from one task to the next. The first draft was made by using Google Maps, but it was a little hard to use references in the environment. A trip to Nyhavna became the solution, which also gave a good opportunity to take pictures to be used in the tasks. I went to the location of each task, took pictures, and followed the planned route to confirm that the directions made sense and came up with some changes. One task had to be removed, since the whole area was closed by a fence. Another task had to be moved because of the same reason, which was a pity, since participants then could not get a full view of the location in question.

To take full advantage of the concept the following should be defined for each task:

Picture:	Each task can show a picture at the top, which for instance can be used to let participants know they are at the right place, draw the participants attention to something, or show scenarios and suggestions.
Task type:	Each task can only be of one type, hence task types cannot be mixed.
Description:	A descriptive text can be added to a task and will appear between the picture and the questions. This can for instance be used to add some background information about the place.
Questions:	Each task can contain an unlimited number of questions, and each question can again contain an unlimited number of alternatives (unless the task type is free text).
Directions:	A short text that explains how to get to the task from the previous task.

8.2 Evaluation: field test

To test the final prototype a field test with four participants was conducted. The test was different from the usability test in a number of ways. First of all, the test was done in a real environment, at a place with an active redevelopment process. Secondly, the survey in the prototype was more carefully designed, and thirdly, the test participants volunteered because of their interest in the concept. These three factors, along with a refined prototype, resulted in valuable feedback on the potential of the concept.

8.2.1 Recruiting participants

A call for volunteers was put out to students at the Faculty of Architecture and Fine Art. This included a description of the app, what the participation would include, and technical requirements for participation. The people who eventually volunteered were four students in the program Physical Planning at Department of Urban Design and Planning, two male and two female. The decision to recruit students from this faculty was not random. The idea was that students from this faculty would be able to put on a dual role while testing and evaluating the prototype. On one hand, it would be likely that they are young and frequent users of apps, and able to see the app from the perspective of a public participant. On the other hand they have knowledge about planning and can see the concept from the perspective of a planner.

8.2.2 How the field test was conducted

Before the field test the participants had already been sent a consent form defining their involvement, and what data would be collected. Physical copies were brought to the test session for signing. To get the session going the context of the test session and the app concept was briefly presented. Some of the participants had already downloaded the app and registered a user. While the last participant got set up, informal talk resolved around their study background and experiences with public participation.

When all the participants had the app set up and registered a user, everyone opened the survey that was prepared for the field test. From that point the author took on the role as observer and did not interfere with how the survey was undertaken, not to influence how the participants perceived the survey. The group stayed more or less together during the survey, but answered the tasks individually.

After the survey the participants got the chance to post suggestions and interact with the rest of the app. Afterwards, a semi-structured group interview was held with all four participants. This interview provide the basis for the results of the field test.

8.2.3 Field test results

Since there were four people in the interview, one persons answer often lead to someone else following up on what was said. This was an interesting consequence of holding a group interview, but could also lead to follow-ups drifting away from the original question. Sometimes topics were also brought back up at a later point. For this reason the results are summarized under topics and not chronologically.

Type of tasks

M1 found the linear scale in the form of a slider the most interactive types of task, which was something positive. It was easy to interact with the slider. In comparison, the task where you had to write text felt more cumbersome, but at the same time he pointed out that it was good to have different types of tasks. F2 agreed, and pointed out that the tasks with checkboxes were also good. M1 suggested that there could be other type of tasks to make the survey more exiting and more like a game to fit the target group. For instance, when reaching Dora [a submarine bunker visited during the test], one task could be to have a concrete wall that participants should tag on their phones. One way to implement this could be to mix such tasks with the existing tasks. He was, however, not sure what value this would have in the context of public participation. F1 later brought this back up and and had the idea that participants could take pictures and then draw on top of them. This is something young people are already familiar with from popular apps, and would be an activating element of the survey. There were also some comments about the questions themselves. These concerned missing alternatives in one of the questions, and that some of the questions were too mature for participants down to 13 years old.

Engagement of treasure hunt

Asked whether or not the survey was engaging in itself, F2 said the survey was like a treasure hunt, at least if there would be some kind of reward when you reach the goal. She liked that you continuously could see the distance to the next tasks, and she was motivated by reaching the next place. F1 suggested that after a task is posted, the participant could be given a hint to what will be found at the next location to build an expectation. This could also be helpful for the orientation. F2 agreed that this would be nice. In some cases she found the GPS signal a

bit unreliable. If such a hint could make it possible to recognize the location of the next task even from a distance, it would be easier to get there even if the GPS signal sometimes was misleading. To increase engagement of the survey, M2 suggested to add a timer that starts when participants search for tasks, and automatically stops when they are found. The total time spent finding tasks could then be summarized at the end and used to calculate a score.

Information in tasks

F1 and F2 quickly responded yes when asked if different types of information were an important part of the tasks. M1 referred to the tasks that included links to websites, and thought it would be nice if links were integrated into the app, so they could be clicked and provide more information on the spot. F1 suggested that since the focus is on urban development, it would be nice to have some tasks that showed old pictures of that place to let the participants reflect over the changes.

Activities along the route

M1 suggested to add small challenges along the route, like a treasure hunt where you get points for completing the challenges. It could for example be questions that were more like a quiz. For instance, when walking past Dora, a question could be how thick the walls are. After answering the correct answer could be revealed. F1 had previously been involved in organizing a "Barnetråkk" which involves children using a website to mark places that they use and express how they feel about them. This was the same tool that the municipality worker interviewed in the first iteration had been involved in. F1 pointed out that the concept of placing symbols on the map could be an additional feature of the survey. There could be some buttons in the map the participants can press to place a certain symbol at the current location. The symbols could simply be a green and red mark to indicate positive and negative places, or there could be several different symbols to choose from.

Scenarios

M1 mentioned that there has been competitions at Nyhavna, where people have been invited to share their visions for the area. F1 continued by saying that the app could give the opportunity to view the different visions. "Yes, and then people could say which one they like the most", M1 said. To support this idea, F1 said it is sometimes easier to react to something than to come with suggestions, but that it depends on what the goal of the participation is. Sometimes the planner wants to get suggestions, while other times responses to something. Continuing on the idea of different visions, M1 got the idea of having a set of scenarios that for instance represents various levels of urbanity. On one end of the scale is a super-urban scenario, and on the other end is

something more like a village. Participants could then be asked to choose one of the scenarios. F1 mentioned a digital dissemination trail called "Garborgløypa[1]", which allows people to scan QR codes at several different locations, and then watch video clips or listen to audio recordings about the history of that place. She meant that this could be implemented in an app for urban planning, having videos present visions and scenarios, and that this would be an effective way of doing plan consultations.

Use for planning

Asked whether or not they thought they could have used such an app to facilitate public participation and get the data they needed, M2 was positive. He used the fact that planners have the freedom to design the tasks and decide where participants should go to argue that he thought it would work. At the same time he pointed out that it should be possible for planners to set a time frame in which a survey is open, and present summaries of the responses to the participants after the survey has been closed. One way of presenting the results could be to let participants open the map of the survey and click on the tasks to see the response statistics. F1 thought it was a good tool with a lot of potential, especially since it would allow to reach a target group that normally do not engage that much in urban planning. Since the planner can choose locations, it is possible to draw people to visit new areas, so they can get an impression of what it is like. M1 hoped such an app would become available. He did also mention that some municipalities have digitalized their plan consultations, but that this is for another target group, and that such an app would increase the availability.

Various suggestions

M1 thought there should be an indicator of the progression while taking a survey. It would not be necessary to show the whole route, but show how many tasks that are completed and how many are left. This would increase the feeling of moving forward.

M2 suggested that projects could be sorted on municipalities. A municipality could then host a competition for a certain period of time. The municipality would then have their own top list and a winner could be selected from this list, either by selecting the one on the top, or by drawings lots between participants above a score threshold.

M1 suggested a concept where the participant is shown the map of an area, and a set of functions, for instance public park, bench and stores. The participant would then be asked to place

[1] http://www.jaermuseet.no/garborgsenteret/garborgloypa-2

these function on the map.

F1 wished that the map would have been more detailed, so it would be easier to use for navigation, and thought this would be especially good for children.

8.3 Discussion

The participants were asked whether or not they thought the survey itself was engaging. F2 confirmed that it was like a treasure hunt and also said that she was motivated to find the next location, but seemed to think that there could have been an extra reward for reaching the goal. To better fit younger people, M1 suggested to add activities that were more engaging, and F1 talked about activities that were activating. Several suggestions for how this could be achieved were brought up, and indicates that this is an area with more potential.

Some of the suggestions indicate that it is the time between tasks that can be unengaging. These suggestions were to add a timer between tasks, add quiz questions, and add the ability to place various markers. What these suggestions have in common is that they add some activity along the route of the survey. Also the suggestion to add a hint about what the next location is like was to increase the expectation, and hence make the walking more engaging.

An interesting comment was the differences between reacting to something and coming up with suggestions, and that which one is preferred by the planner depends on the goal of the participation. Ideally, the solution should enable the planner to make this decision and design appropriate tasks. Right now the solution enables the planner to add one picture to each task, and in this way makes it possible to present one scenario per task, unless several scenarios are crammed into one picture, or the scenarios are described textually. To support the idea of scenarios, the possibility to add several pictures to each task could be implemented. One could also imagine that the pictures could be replaced by videos, as it was done in the digital dissemination trail mentioned by F1.

M2 had an interesting suggestion about how the results from a survey could be made available to everyone after the survey had closed. In the current prototype, when a participant has taken a survey, it cannot be opened again. If surveys had a time limit, and after the time has passed, the map of the survey could reappear, this time with all the pins immediately visible. The aggregated result from a task could be shown by touching its pin. This would solve the problem that the communication only flows in one direction – from citizens to planners. The solution already

supports this and communication between citizens, but not communication from planners to citizens (except for project descriptions). Publishing the results would be a good first step to make information flow in both directions, and the next step would be to inform citizens about how the results are used, and finally what impact they had.

9 Conclusion

9.1 Summary

This research set out to investigate how to design an app that could support the participation of children and youth in urban planning. Based on a review of methods of participation, it was decided to focus on situated engagement and game elements. A review of relevant literature was then conducted to learn from previous work. The next step was to design the app, and this was done in three iterations. Most of the concept was designed during the first iteration, and was evaluated with expert interviews. The experts were overall very positive to the concept. The second iteration comprised the implementation of a functional prototype. A usability test was run with the prototype, and concluded that the prototype was very usable, and also resulted in some ideas for improvements in the next iteration. In addition to these improvements, the third iteration added some functionality, most notably new type of tasks for the survey. The final evaluation was a field test held with students of urban planning, and confirmed the potential of the concept.

9.2 Contributions

The results from each iteration have been discussed in each chapter. This section summarizes the findings based on the research questions.

SRQ-1: Can situated engagement increase awareness of challenges and opportunities?

The fact that smartphones are increasingly available and always with us was a driving point for focusing on the potential situated engagement. But just as important was the idea that if youth have to go to a specific place and then provide feedback about that place, the quality of the feedback will be better compared to a traditional survey. Good feedback was then thought of as feedback that reflects awareness of challenges and opportunities.

It is not easy to give a definite answer to this question, but findings suggest that there is a potential. These are some of the statements made during interviews that supports the idea:

- Maps easily can be misunderstood, and it is therefore a good idea to go to the actual location.
- It is easier for youth to provide feedback when they see something.
- Since the participants have to move around they can gain new perspectives, and hence increase quality of feedback.
- When people move around they can say something about the potential of a place and how it can be made attractive.

In two cases it was suggested that situated engagement would be especially useful in areas that people do not often go to, which implies that people benefit from seeing a place before they give feedback. The suggestion to show old pictures of a place in the survey also supports the idea of situated engagement, since it implies that reflection over changes can result in more informed feedback.

SRQ-2: Can game elements motivate to use the app?

The evaluations showed a very positive attitude towards the idea of using game elements to make participation engaging. Some thought that the game elements in the prototype would work, but whether or not the game elements in the prototype can motivate for continued participation cannot be confirmed without testing over a longer period. A question that remains is whether or not the app would be used by children and youth on their own initiative, or if it would have to be part of something organized. The youth city council member thought peo-

ple would engage on their own initiative as long as the projects were seen as interesting and preferably close to their home. The other experts focused on how the situated engagement was beneficial for exploring new places, which can explain why they were less convinced that the app would work without organized events. In two cases it was suggested that the app could be used in school classes, and that it would be fun for the pupils to compare their scores at the end of the day. One of the students in the last evaluation took this a step further, suggesting that municipalities could host time limited projects, and that the scores of the users could be used to draw a winner at the end. There were also several suggestions for new game elements that could have been integrated into the app, which confirms that game elements in general were seen as a good element for motivation.

9.3 Limitations

I do not have any previous experience with such a rigorous process that this work has been, so some parts could naturally have been done better. While transcribing interviews, for instance, it became clear that more follow-up questions could have been asked to gather more details. In one instance it could also have been stated more clearly at the beginning of the interview what the main purpose of the interview was. The lack of this clarity resulted in much talk about how the concept could be realized (which was very exiting), but some missing details on the feedback about the concept itself.

The final field test could also have been planned better, and would probably have benefited from a pilot test. The main challenge was that the treasure hunt lasted longer than expected, so there was limited time to test the remaining functionality of the app afterwards.

9.4 Reflections on the work

Looking back at my work, I think it would have been beneficial to narrow the scope and focus less on implementing functionality in the prototype. A lot of time was spent on implementing functionality that was not thoroughly tested and could have been omitted without affecting the results of my work. By narrowing the scope I could have implemented a smaller number on functionalities, made a functional prototype faster, and spent more time on testing, and perhaps worked more to realize a larger test with the target group. On the other hand, since the app I have created has a lot of functionalities it would be feasible for someone to continue developing

the app and realizing it.

9.5 Future work

If the work was to be continued it would have been interesting to implement and test some of the features that were suggested during interviews. The ones I found the most interesting are:

- Possibility to place various symbols on the map as you go from one location to another, for instance symbols for positive and negative places.
- Quiz-like questions that appears between tasks. The correct answer is revealed after answering and correct answer gives extra points.
- Possibility to take pictures and draw on them. Could be a part of both surveys and suggestions.
- Possibility for planners to add links in a task description that opens a new view with more information about something related to the task.
- Make the results from a survey available after it is closed.

If the solution was to be realized and used in practice, the interface for planners would have to be created. This could for instance be a web app, enabling planners to create projects and surveys, and see survey results and suggestions. The app should also have been created for other platforms, iOS being a natural choice besides Android.

There has been much interest in the app from various stakeholders. At the time of delivering this thesis there was an ongoing dialog about the possibilities to use the app in the process of gathering all the campuses of NTNU in one place[1], which is planned to run from 2016 to 2025.

[1] More information about this project can be found here: https://www.ntnu.no/campusutvikling

References

[1] M. Reiersølmoen, "Facilitating children and youth's participation in urban planning," 2015.

[2] T.-P. Ertiö, "Participatory apps for urban planning—space for improvement," *Planning Practice & Research*, vol. 30, no. 3, pp. 303–321, 2015.

[3] A. R. Hevner, "A three cycle view of design science research," *Scandinavian journal of information systems*, vol. 19, no. 2, p. 4, 2007.

[4] M. Francis and R. Lorenzo, "Seven realms of children's participation," *Journal of Environmental Psychology*, vol. 22, pp. 157–169, 2002.

[5] G. Lansdown, "The realisation of children's participation rights: Critical reflections," in *A Handbook of Children and Young People's Participation*, B. Percy-Smith and N. Thomas, Eds. Routhledge, 2010, pp. 11–23.

[6] C. S. Hevner, Alan, "Design science research in information systems," in *Design Research in Information Systems*, C. S. Hevner, Alan, Ed. Springer US, 2010, pp. 9–22.

[7] R. H. von Alan, S. T. March, J. Park, and S. Ram, "Design science in information systems research," *MIS quarterly*, vol. 28, no. 1, pp. 75–105, 2004.

[8] M. Francis, "Negotiating between children and adult design values in open space projects," *Design Studies*, vol. 9, no. 2, pp. 67–75, 1988. [Online]. Available: http://www.sciencedirect.com/science/article/pii/0142694X88900324

[9] C. Freeman, *Creating Child Friendly Cities: New Perspectives and Prospects*. Routledge, 2006, ch. Colliding worlds: Planning with children and young people for better cities.

[10] S. Bartlett, "Building better cities with children and youth," *Environment and Urbanization*, vol. 14, no. 3.

[11] L. Horelli, "A methodological approach to children's participation in urban planning," *Scandinavian Housing & Planning Research*, vol. 14, no. 3, pp. 105–115, 1997.

[12] J. Wilks and J. Rudner, "A voice for children and young people in the city," *Australian Journal of Environmental Education*, vol. 29, no. Special Issue 01, pp. 1–17, 2013.

[13] M. Corsi, "The child friendly cities initiative in italy," *Environment and Urbanization*, vol. 14, no. 2, pp. 169–179.

[14] R. Hart, "Children's participation: From tokenism to citizenship," *Innocenti Essays*, vol. 4, 1992.

[15] J. E. Innes and D. E. Booher, "Reframing public participation: strategies for the 21st century," *Planning Theory & Practice*, vol. 5, no. 4, pp. 419–436, 2004. [Online]. Available: http://dx.doi.org/10.1080/1464935042000293170

[16] R. A. Irvin and J. Stansbury, "Citizen participation in decision making: Is it worth the effort?" *Public Administration Review*, vol. 64, no. 1, pp. 55–65, 2004. [Online]. Available: http://dx.doi.org/10.1111/j.1540-6210.2004.00346.x

[17] N. Roberts, "Public deliberation in an age of direct citizen participation," *The American Review of Public Administration*, vol. 34, no. 4, pp. 315–353, 2004.

[18] M. Korn, "Situating engagement: Ubiquitous infrastructures for in-situ civic engagement," Ph.D. dissertation, Aarhus University, The address of the publisher, 1 2013.

[19] E. Gordon, S. Schirra, and J. Hollander, "Immersive planning: A conceptual model for designing public participation with new technologies," *Environment and Planning B: Planning and Design*, vol. 38, no. 3, pp. 505–519, 2011. [Online]. Available: http://epb.sagepub.com/content/38/3/505.abstract

[20] L. Halprin, R. T. J. Hester, and D. Mullen, "Lawrence halprin [interview]," *Places*, vol. 12, no. 2, pp. 42–51, 1999.

[21] F. Alt, A. S. Shirazi, A. Schmidt, U. Kramer, and Z. Nawaz, "Location-based crowdsourcing: Extending crowdsourcing to the real world," in *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries*, ser. NordiCHI '10. New York, NY, USA: ACM, 2010, pp. 13–22. [Online]. Available: http://doi.acm.org/10.1145/1868914.1868921

[22] M. Y. Virpi Oksman, Antti Väätänen, "Co-creation of sustainable smart cities: Users, participation and service design," in *The Eighth International Conference on Mobile Ubiquitous Computing, Systems, Services and Technologies*, ser. UBICOMM 2014. IARIA, 2014, pp. 189–195.

[23] B. Y. Clark, J. L. Brudney, and S.-G. Jang, "Coproduction of government services and the new information technology: Investigating the distributional biases," *Public Administration Review*, vol. 73, no. 5, pp. 687–701, 2013. [Online]. Available: http://dx.doi.org/10.1111/puar.12092

[24] M. Castells, M. Fernandez-Ardevol, J. L. Qiu, and A. Sey, *Mobile communication and society: A global perspective*. Mit Press, 2009.

[25] K. O'Hara, "Understanding geocaching practices and motivations," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI '08. New York, NY, USA: ACM, 2008, pp. 1177–1186. [Online]. Available: http://doi.acm.org/10.1145/1357054.1357239

[26] M. A. Wimmer, R. Grimm, N. Jahn, and J. F. Hampe, *Electronic Participation: 5th IFIP WG 8.5 International Conference, ePart 2013, Koblenz, Germany, September 17-19, 2013. Proceedings*. Berlin, Heidelberg: Springer Berlin Heidelberg, 2013, ch. Mobile Participation: Exploring Mobile Tools in E-Participation, pp. 1–13. [Online]. Available: http://dx.doi.org/10.1007/978-3-642-40346-0_1

[27] M. Bohøj, N. G. Borchorst, S. Bødker, M. Korn, and P.-O. Zander, "Public deliberation in municipal planning: Supporting action and reflection with mobile technology," in *Proceedings of the 5th International Conference on Communities and Technologies*, ser. C&T '11. New York, NY, USA: ACM, 2011, pp. 88–97. [Online]. Available: http://doi.acm.org/10.1145/2103354.2103367

[28] M. Allen, H. Regenbrecht, and M. Abbott, "Smart-phone augmented reality for public participation in urban planning," in *Proceedings of the 23rd Australian Computer-Human Interaction Conference*, ser. OzCHI '11. New York, NY, USA: ACM, 2011, pp. 11–20.

[Online]. Available: http://doi.acm.org/10.1145/2071536.2071538

[29] C. Schröder, "A mobile app for citizen participation," in *Proceedings of the 2014 Conference on Electronic Governance and Open Society: Challenges in Eurasia*, ser. EGOSE '14. New York, NY, USA: ACM, 2014, pp. 75–78. [Online]. Available: http://doi.acm.org/10.1145/2729104.2729137

[30] K. E. P. C. Annika Kangas, Jussi Rasinmäki, "A mobile phone application for the collection of opinion data for forest planning purposes," *Environmental Management*, vol. 55, no. 4, pp. 961–971, 2015.

[31] U. Lehner, M. Baldauf, V. Eranti, W. Reitberger, and P. Fröhlich, "Civic engagement meets pervasive gaming: Towards long-term mobile participation," in *Proceedings of the Extended Abstracts of the 32Nd Annual ACM Conference on Human Factors in Computing Systems*, ser. CHI EA '14. New York, NY, USA: ACM, 2014, pp. 1483–1488. [Online]. Available: http://doi.acm.org/10.1145/2559206.2581270

[32] A. B. Hirsch, "Scoring the participatory city: Lawrence (& anna) halprin's take part process," *Journal of Architectural Education*, vol. 64, no. 2, pp. 127–140, 2011. [Online]. Available: http://dx.doi.org/10.1111/j.1531-314X.2010.01136.x

[33] J. M. Gallaugher and S. C. Ramanathan, "Choosing a client/server architecture." *Information Systems Management*, vol. 13, no. 2, p. 7, 1996. [Online]. Available: http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=9602130979&site=ehost-live

[34] T. S. Tullis and J. N. Stetson, "A comparison of questionnaires for assessing website usability," in *Usability Professional Association Conference*, 2004, pp. 1–12.

[35] J. Brooke *et al.*, "Sus-a quick and dirty usability scale," *Usability evaluation in industry*, vol. 189, no. 194, pp. 4–7, 1996.

[36] A. Bangor, P. Kortum, and J. Miller, "Determining what individual sus scores mean: Adding an adjective rating scale," *Journal of usability studies*, vol. 4, no. 3, pp. 114–123, 2009.

Appendices

A Interview protocol

This document describes how I want to collect feedback on the first prototype of my app concept. The goal is to get feedback on the concept, so it can be used to improve the concept before the second iteration where I implement a working prototype.

A.1 Introduce the work and start the conversation

Studying computer science at NTNU with specialization in software. Currently working on my master thesis about engaging young people in urban planning utilizing smartphones.

Architect and municipality worker

- Do you think it is a challenge that young people in general are hard to engage in urban planning?
- Do you think it would be positive if more young people became engaged in urban planning?

Youth council member

- How much influence do you feel members of the youth city council are given?

A.2 Present the concept

Present the concept as clearly as possible. Start with the big picture, and not go into details right away. Make a PowerPoint presentation that goes through a scenario.

A.3 Present the low fidelity prototype

When the concept is explained I will show every screen of the prototype. When the concept is already explained these screen should make more sense than if they were presented right away.

A.4 Let them play around with the prototype

Now they can test the prototype themselves on a phone. It should give a feeling of how the app will work. The main goal is that they understand the concept, though some tips about usability might also appear.

A.5 Semi-structured interview

I am open to any feedback concerning the concept, but here are some guidelines for what I would like to know.

Architect and municipality worker

- Do you think youth are given an authentic opportunity to engage through this app?
- Do you think useful data can be collected with these two types of tasks? Could there be any other types of tasks?
- Do you image that such an app could be used in a real-world scenario?
- In a real scenario, do you image that the open suggestions would have an impact?
- Do you see any challenges from a project manager's point of view?

- Do you think a tour through locations could increase the youth's understanding of challenges and opportunities connected to the planning project?
- Do you think the tour will increase the quality of the feedback?
- Do you think showing facts in each task could increase youth's understanding of urban planning processes?
- Do you consider it appropriate to pair participation in urban planning with game elements? Could it compromise the quality of collected data?

Youth council member:

- Which functionality do you think you would enjoy the most?
- What do you think would be youth's main motivation for using the app?
- Do you think it would be interesting to have a map show all ongoing planning projects?
- Do you think the tour would enable you to provide better feedback?
- Do you think it would be interesting to get facts at each location during the treasure hunt?
- Do you think the treasure hunt adds some fun to the participation?
- Do you think youth will be motivated by score and achievement?
- Do you think youth will be motivated by seeing their names of a high score list?

B

Usability test protocol

This document describes how I am going to conduct the evaluation at the end of the second iteration. At this point I have an functional prototype to be evaluated. The intention of the evaluation is:

- Evaluate the usability of the app
- Test the functionality of the app in a close to real scenario

The results of the evaluation will be used to make the app ready for a beta test with more users. The following sections will explain step by step how the test will be conducted.

B.1 Consent form

Delta! usability test

This data collection is part of research activities within the work of a master thesis written for Department of Computer and Information Science at the Norwegian University of Science and Technology. The objective of the study is to investigate how a mobile application can be designed to help young people engage in urban planning.

The data collected includes video recordings, screen recordings, data recorded in the mobile application and questionnaire response. Your data will be held and used on an anonymous basis only for the purpose of this master thesis and related work. Your raw data will be kept confidentially and not disclosed to third parties. Reports on this study won't contain any personal data or data that could lead to the identification of a specific data subject.

Declaration on consent: I hereby declare my consent that my data may be conveyed and documented for the above stated purpose. I confirm that my participation is voluntary. I am aware that I may withdraw my consent at any time.

Date:	.....
Name:	.....
Signature:	.....
Signature data collector:	.....

Please provide your contact data if we are allowed to contact you again with regard to your data:

This information will of course be stored separately from your data!

_____

_____

B.2 Introduce the app concept

Delta is an app made to make it fun and engaging to participate in urban planning. Inside the app you will find planning projects marked on the map. For each project there is a survey you can take. The survey is like a treasure hunt, where your task is to follow directions, find all the locations, and provide some feedback on each location. Inside the app surveys are called missions. After completing surveys you will be able to post suggestions and respond to suggestions posted by other users. These activities will increase your score, which you can compare with other users.

B.3 Tasks

The main part of the evaluation will be a set of tasks each participant must complete. The tasks go through all the functionalities of the app one step at a time, and should be enough to give the participants a good perception of the usability. In addition to this, the undertaking of the tasks will happen in a context similar to the intended use of the app. It is therefore an important part of the evaluation to see whether or not there will be any technical difficulties, as this should help identify any errors in the app, or unforeseen factors that disturb the usage of the app.

It is important, however, that the participant is able to complete the tasks despite technical difficulties that may arise. Preferably the test will be done on the participant's own smartphone, but a backup device that has been tested before will also be available. In the case that the phone is not able to determine the participant's position with high enough precision (meaning it will be impossible to come close enough to the target locations), a hidden cheat will be added that the observer can reveal if necessary, so the mission can be completed. If other connectivity issues hinder the tasks, the test can be brought to a lab environment, so the participant still can give feedback on the usability. Following are the tasks, exactly like they will be presented to the participants.

1. Register a user

Congratulations! You are now in possession of the first version of the app Delta! Your first task will be to open the app, register a user with the registration code 'alfa', and log into the app.

2. Complete the mission for the campus project

The Norwegian University of Science and Technology is going to have all its five campuses integrated into one city campus. As a part of this process the board is interested in the opinions of students, and have set up several locations that they want students to visit and give their feedback on. This is your next task – open up the page for the campus project in the app, read more about the project if you want to, and then start the mission. You will be given descriptions of what to do as you go along. Good luck!

3. Post a suggestion to the campus project

Now that you have seen the area and completed the mission you might have some interesting ideas or suggestions. Post a suggestion to this project with a title, description and image. When the suggestion is posted, open it again and make sure to express agreement with your own suggestion.

4. See how your profile is doing

As you complete actions in the app your score and other statistics will increase. Go to your profile page and have a look. And when you are there you might also want to add a profile picture to get rid of that boring gray circle at the top. The profile picture will be visible other places in the app as well.

5. Give feedback to a suggestion

You are luckily not the only user in the app, and there have already been posted many suggestions. Go to any of the projects, find a suggestion you think is interesting, and express your opinions about the suggestion.

6. Check your status on the leader board

You have now done a lot, and by this increased your score. As you already have seen, the score in available on your profile page. If you are lucky you have also gained enough score to climb onto the leader board! Go to the leader board and see which position you are in. Please explain what you see.

7. Take a look at what you have done so far

A lot has happened since you started off with the mission, and it can easily be forgotten. Go to the activity log and recap your participation for today. Please explain what you see.

B.4 Observation checklist

Task	Comment
Find register button	
Register a user	
Log in	
Open the campus project	
Start the mission in the campus project	
Read first task explanation	
Go to starting point	
Go to first location	
Answer task 1	
Go to second location	
Answer task 2	
Go to third location	
Answer task 3	
Go to fourth location	
Answer task 4	
Go to fifth location	
Answer task 5	
Post suggestion to campus project	
Take a look at the profile	
Give feedback to suggestion	
Check status on leader board	
Look at activity log	
Other	

B.5 Questionnaire

1 = strongly disagree, 5 = strongly agree

1	I found the system unnecessarily complex	1	2	3	4	5
2	I thought the system was easy to use	1	2	3	4	5
3	I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
4	I found the various functions in this system were well integrated	1	2	3	4	5
5	I thought there was too much inconsistency in this system	1	2	3	4	5
6	I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
7	I found the system very cumbersome to use	1	2	3	4	5
8	I felt very comfortable using the system	1	2	3	4	5
9	I needed to learn a lot of things before I could get going with this system	1	2	3	4	5

C

Field test protocol

This document describes how I am going to conduct the final evaluation. The prototype has been refined and some new functionality has been added. The evaluation will be in the form of a field test, and the intention is to test the prototype out in the wild. The participants will complete a survey, and will afterwards have the opportunity to post and discuss suggestions. The evaluation will end with a semi-structured group interview, where they will be asked questions about the concept and the prototype.

C.1 Consent form

Delta! field test

This data collection is part of research activities within the work of a master thesis written for Department of Computer and Information Science at the Norwegian University of Science and Technology. The objective of the study is to investigate how a mobile application can be designed to help young people engage in urban planning.

The test session consist of two parts: testing of a mobile application at Nyhavna, Trondheim and an interview. During the testing these data will be collected:

- Video recording of the screen
- Audio recording
- Content created in the application
- Position data after arrival at Nyhavna

The interview after the testing will also be audio recorded. Data gathered will be held and used on an anonymous basis only for the purpose of this master thesis and related work. Location data is stored in a way so it cannot be traced back to your identity. All data will be kept confidentially and not disclosed to third parties. Reports on this study will not contain any personal data or data that could lead to the identification of a specific data subject.

Declaration on consent: I hereby declare my consent that my data may be conveyed and documented for the above stated purpose. I confirm that my participation is voluntary. I am aware that I may withdraw my consent at any time.

Date:	.....
Name:	.....
Signature:	.....
Signature data collector:	.....

C.2 Test session

The participants will receive a description of the prototype before the test, and also a description of what the test involves. The main task will be to complete a survey at Nyhavna. The participants will be motivated to take pictures during the survey, that they later can use to post suggestions.

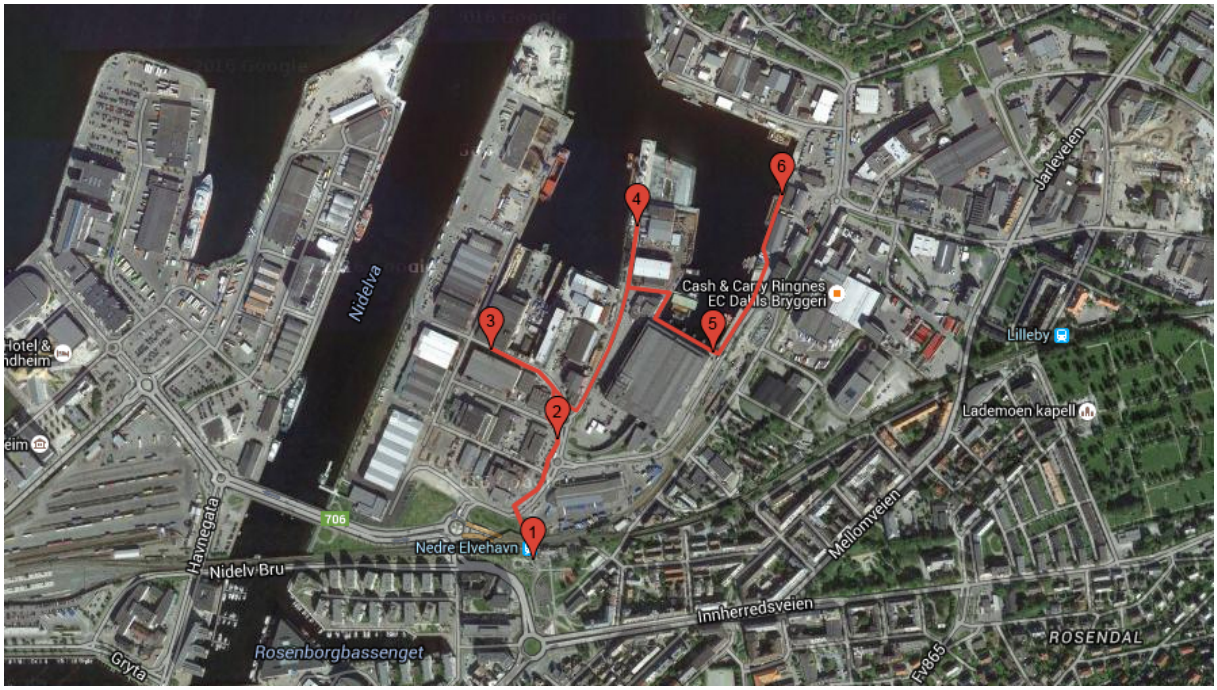


Figure C.1: Map of the survey task locations for the field test

The task that was given at each location is shown in Figures C.2, C.3, C.4, C.5, C.6 and C.7.

C.3 Semi-structured interview

Before the test session

- Have you previously been involved in urban planning?
- Are you familiar with the planning process at Nyhavna?
- What experiences or thoughts do you have about public participation?
- Do you have any thoughts about the inclusion of children and young people in urban planning?

About the treasure hunt

- How was it to find the locations of the treasure hunt?
- How do you find the concept of tasks at specific places?
- In the treasure hunt were three different types of tasks. What do you think of each of them?
- Do you think the treasure hunt itself can be a way of creating engagement?
- Was there anything specific that motivated you to find the next task?
- Do you think the treasure hunt can help the participant to better understand challenges?
- Do you think the treasure hunt can help the participant to see new opportunities?
- Do you think the quality of the feedback is increased by asking questions about the current place, or the path they just walked?
- What role do you think information in the tasks play (for instance information about stakeholder and history)?
- Did you make up any opinions or suggestions along the treasure hunt?

Game elements

- What do you think about having achievements, scores and top list?
- Do you think the game elements can motivate the participant to continue using the app?

General

- Do you feel like the app gives the opportunity to contribute in a meaningful way?
- Is the app something you could image to use to facilitate public participation?

Figure C.2: Task 1

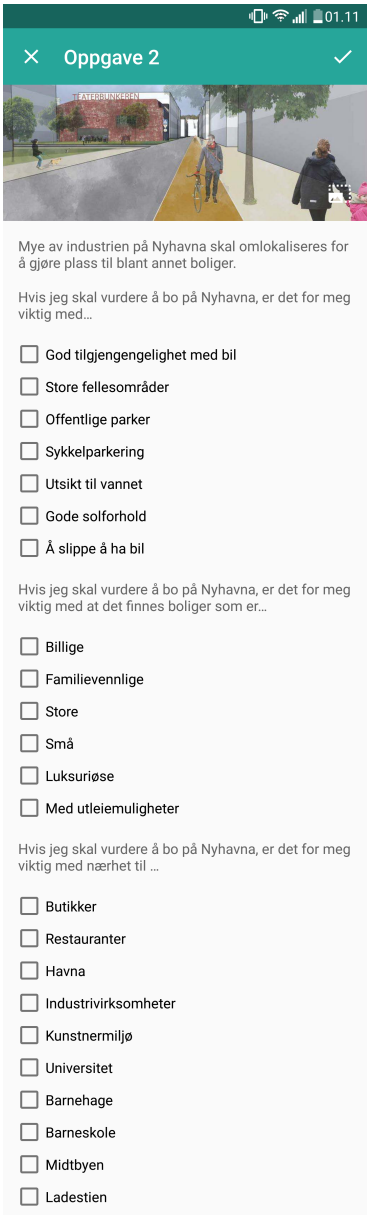


Figure C.3: Task 2

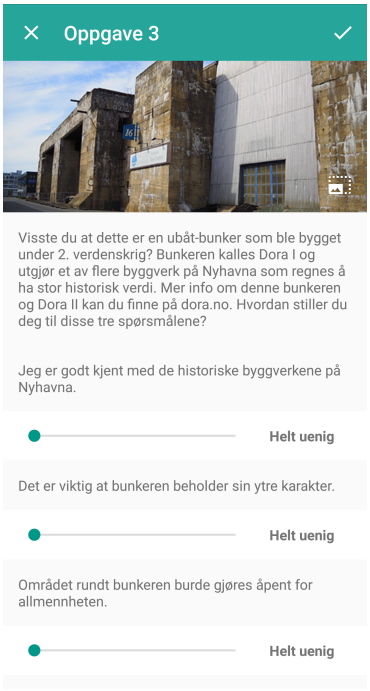


Figure C.4: Task 3

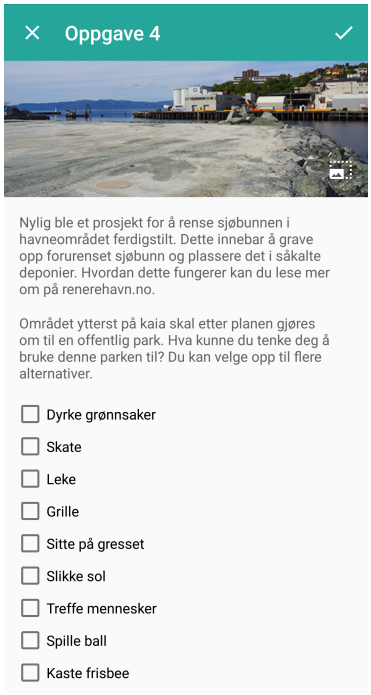


Figure C.5: Task 4

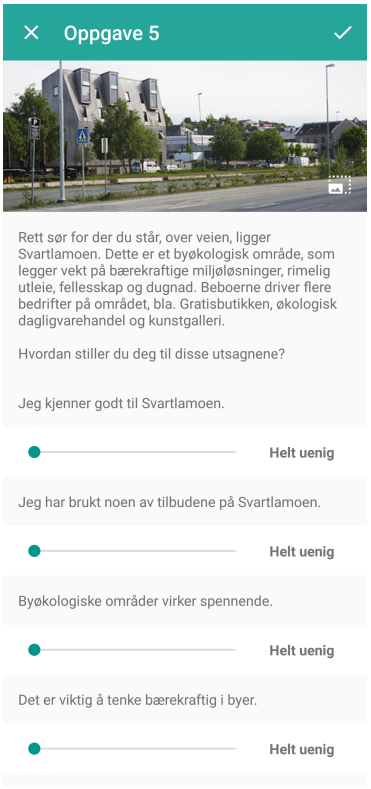


Figure C.6: Task 5

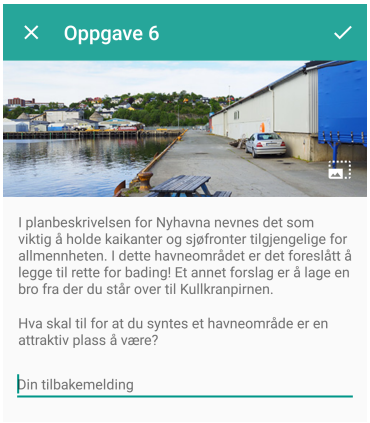


Figure C.7: Task 6