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BACHELOR'S THESIS IN INFORMATION SYSTEMS

# STREAMLINING AN ADMINISTRATIVE SERVICE THROUGH DIGITALIZATION

Developing a digital solution for a manual renting  
service process in Kristiansand municipality using  
Power Apps

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## Preface

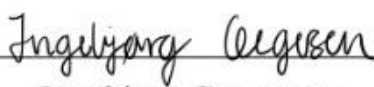
The following report holds the project of group 17 in the course IS-304, *bachelor's thesis in Information Systems*. The purpose of the report is to demonstrate the decisions that have been made, why they have been made, and show the knowledge acquired throughout the bachelor's degree. Developing in a new environment, Microsoft Power Platform, required new skills. Previous knowledge and understanding gained through the degree have equipped us with the ability to gain relevant knowledge, which made this process less challenging, and led to positive results.

We would like to express our appreciation to Atea and Ingeniørvesenet in Kristiansand municipality for giving us the opportunity to acquire relevant and realistic working experiences. Above all, thank you, Ingvild Tisland, for the endless help and guidance provided throughout the process. Furthermore, we would like to thank Ingeniørvesenet for their belief and trust in us throughout the project. Additionally, we would like to thank our course coordinator, Hallgeir Nilsen, and our supervisor, Geir Inge Hausvik, for their advice and encouragement. Lastly, we appreciate the work each team member has done. We are proud that the effort that has been put in has led to a positive result. Statements from the project supervisor and the project owners can be found in Appendix 1 and 2, respectively.


**Kristiansand**

**16.05.2023**

  
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## Abstract

The team completed the project for Ingeniørvesenet in the spring of 2023 as a requirement for the IT and Information Systems bachelor's degree. This assignment is written for Atea, a leading IT company in the Nordics and the Baltic States (Atea, n.d.). We have developed an application through Power Apps in Microsoft Power Platform, where we have digitalized a manual renting-service process for Ingeniørvesenet. The application aims to simplify the regular process of renting vehicles for construction work in Kristiansand municipality. The project's development began in January. By the beginning of June, a completed application should be ready to be delivered and presented to Ingeniørvesenet and Atea.

This report will describe the decisions made during the project and provide an explanation for them. The four fundamental Agile Manifesto principles and some Scrum artifacts define the methodology used (Edy, 2016). The team has accomplished project improvement with continuous Sprint Reviews, specific Sprint goals, and effective communication within the team. The team collected significant information to outline the user's demands to guarantee product quality. To achieve a high-quality solution, the team integrated a risk assessment, engaged in various Microsoft courses for Power Apps, and performed user testing throughout the design and development phase.

Further, the interviews and user testing was analyzed. This led to an understanding of possible improvements in the already existing system. The research led to the structure and design of the application. Afterward, techniques like mockups, wireframes, and David Benyon's design principles were utilized to develop the final user interface design.

The team has defined the goal that the application should provide a minimum viable product. The development of the application started later than anticipated due to a lack of competence within the Microsoft Power Platform. Despite these difficulties, the procedure led to the creation of a compatible system. We are pleased with the results and the learning that we have achieved.

A walkthrough of the system developed can be viewed [here](#).

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## 1 Introduction

The following report is written as part of the course IS-304, *bachelor's thesis in Information Systems*. This thesis allows the team to show what has been learned throughout the three years at the University of Agder. This includes project management, design, development, and more. The team has found it rewarding to use the knowledge acquired throughout the degree in a realistic project.

Working together with external parties has been a significant part of this project. The team partnered with Atea on a project regarding the development and implementation of a rental application. The application concerns renting vehicles for employees in Ingeniørvesenet, a department within Kristiansand municipality. The team investigated how this process can be digitalized. Further, a product that shows proof of this concept was produced, and Ingeniørvesenet will afterward have the opportunity to continue developing the application based on the team's results.

Kristiansand municipality aims to undergo a digital transformation, usually achieved by implementing multiple digitalization projects (Kjærner-Semb & Adriansen, 2019, p. 7). This project aims to digitalize a manual rental process for Ingeniørvesenet. Processes are one of the four central aspects of digital transformation (Kjærner-Semb & Adriansen, 2019, p. iii). By helping Ingeniørvesenet with digitalizing one process, the team wishes to encourage them to continue with their digital transformation.

This chapter introduces the project. Here, the different parties involved in the project will be briefly introduced. The different parties include the team, our partner Atea, the product owner, and the client. Lastly, the goals and ambitions for this project will be presented.



## 1.1 Presentation of the team

The team consists of four students in their last semester pursuing a bachelor's degree in IT and Information Systems at the University of Agder. At the beginning of the fifth semester, the team was formed to develop innovative and practical solutions (Figure 1). Members with a wide range of interests and knowledge have been included to work and solve problems together. As a result of this approach, a solid foundation of knowledge and expertise has been established. Additionally, a team contract was made to ensure the team members' expectations were aligned and to avoid potential problems (Appendix 3).

Name	Main responsibility	Other responsibilities
<b>Eigill</b>	Development, documentation, analytics, database design.	Testing, insight work.
<b>Hedvig</b>	Project management, UI design, development, database design.	Communication with the client, testing, insight work.
<b>Ingebjørg</b>	Project management, UI design, development, database design.	Communication with the client, testing, insight work.
<b>Karoline</b>	Documentation, development, database design.	Testing, insight work.

*Figure 1 - Overview of the individual team members of the project*

## 1.2 Presentation of the Product Owner and Client

Atea is a leading provider of IT infrastructure and related services for businesses and public-sector organizations in the Nordic and Baltic regions (Atea, n.d.). The company is a market leader in this sector and is recognized for its high-quality and innovative solutions. With a strong focus on customer satisfaction, Atea has built

long-standing partnerships with its clients, enabling them to stay at the forefront of technology and remain competitive in their respective industries (Atea, n.d.).

Kristiansand municipality is in the southern part of Norway. As the fifth-largest municipality in the country, Kristiansand plays an essential role in the region’s economic, cultural, and administrative landscape (Store Norske Leksikon, 2023). Ingeniørvesenet is an important department within Kristiansand municipality. This department manages the city’s infrastructure, including roads, bridges, water systems, and buildings. Ingeniørvesenet is critical in ensuring Kristiansand’s infrastructure’s safety, efficiency, and sustainability.

The project is a collaboration between Atea, who serves as the client, and Ingeniørvesenet, who acts as the Product Owner on behalf of Kristiansand municipality. The Product Owner and client are presented in Figure 2.

Name	Professional role	Association	Project Role
<b>Ingvild Tisland</b>	IT-consultant	Atea	Client, Project supervisor, and mentor
<b>Kjetil Breistein</b>	Department manager	Ingeniørvesenet, Kristiansand Municipality	Product Owner
<b>Richard Hasselberg Gumpen</b>	Advisor	Ingeniørvesenet, Kristiansand Municipality	Product Owner
<b>Andreas Almedal</b>	Project manager	Ingeniørvesenet, Kristiansand Municipality	Admin end-user

*Figure 2 - Product Owner and Client*

### 1.3 Project Goals and Ambitions

The primary objective of this project is to create a vehicle rental application for the employees of Ingeniørvesenet in Kristiansand municipality. This system will be divided into two applications communicating through a database. Therefore, there will be one administrator application and one regular user application. The goal is to streamline and optimize the vehicle rental process, enhancing the employees' overall experience.

Previously, registering vehicle rentals was manually accomplished through an Excel sheet, resulting in an inefficient procedure. By automating the process using the new system, efficiency will be improved, and a better experience can be provided to the employees. This improvement is visualized through a Rich Picture (Figure 3). A rich picture defines a situation and expresses it to create a mental model, and “[...] can help to open discussion and come to a broad, shared understanding of the situation.” (Better Evaluation, n.d.). The team has set a minimum requirement, which is to implement the key features of the application. These requirements will be the Minimum Viable Product (MVP). However, the team aspires to deliver a product beyond the MVP, which will be further elaborated on in Chapter 2.

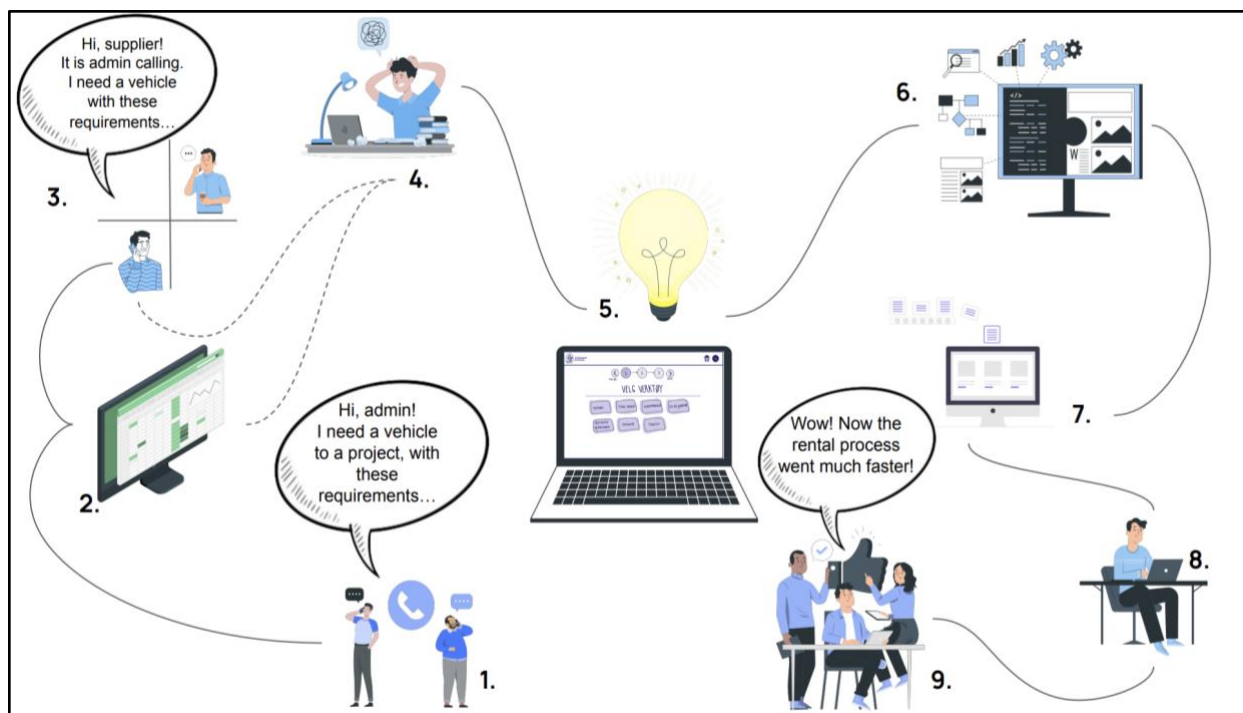


Figure 3 - Rich Picture of the Process

#### 1.4 Overview of the Structure

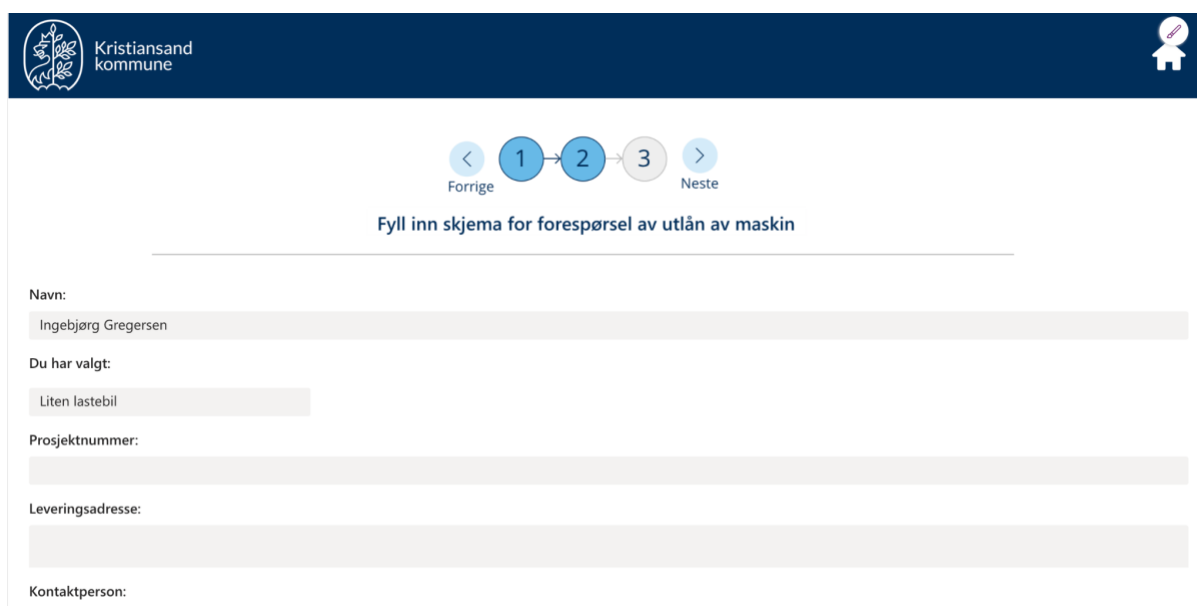
The next chapter introduces the product developed this semester. Chapter 3 focuses on project management. Here, the methodology for the project will be elaborated on, and the quality of the process and product will be discussed. Furthermore, Chapter 4 deals with Data Analysis, presenting the data collected through interviews and user testing. The results of the data collection will be presented in Chapter 5. In Chapter 6, the system design will be introduced, including the technologies and user experience. Chapter 7 provides a more in-depth discussion of quality assurance in the project. Chapter 8 will carefully reflect on the results and teamwork. Finally, Chapter 9 draws a conclusion based on the findings.

## 2 The Product

The following chapter will introduce the MVP for this project and is divided into two sub-chapters. The first subchapter will give a description of the product. In the second subchapter, the team's definition of the MVP, and the most usable product, will be presented.

### 2.1 Description of the product

The product is a rental management system available on the Microsoft Teams collaboration platform for Ingeniørvesents members. The applications are developed using Power Apps and are accessible to all Ingeniørvesents employees. Depending on the users' role in the organization, they will get access to either one, or both applications. The administrator application shows an overview of rental requests and rental status. The administrative user will have the opportunity to approve or decline rental requests. In the app for regular users, employees at Ingeniørvesenet will have the opportunity to go through a rental form, send requests to the administrator, and view the status of their requests. In the rental form, the users can define their needs and requirements for the request (Figure 4). This includes the date of the rental period and various project needs.



The screenshot shows a mobile application interface for Kristiansand kommune. At the top left is the logo and name 'Kristiansand kommune'. At the top right is a user profile icon. Below the header is a navigation bar with three steps: 1 (active), 2, and 3. Step 1 is labeled 'Forrige' and step 3 is labeled 'Neste'. The main heading is 'Fyll inn skjema for forespørsel av utlån av maskin'. The form contains several input fields: 'Navn:' with the value 'Ingebjørg Gregersen', 'Du har valgt:' with the value 'Liten lastebil', 'Prosjektnummer:', 'Leveringsadresse:', and 'Kontaktperson:'.

Figure 4 - Rental form for small truck

## 2.2 Minimum and most viable product

To decide whether the product's development goal has been achieved, it must be defined. Goal achievement goes along a scale, from the minimum viable product (MVP) to the most usable product. MVP provides sufficient functionality to satisfy clients in the start phase while also gathering feedback for future product development (Suscheck, 2020). The system definition defined by the team, as well as the process of how it was developed, can be found in Subchapter 4.2.1. Based on the system definition and information from the Product Owners, the team was able to define the MVP in collaboration with Ingeniørvesenet.

The team defines the MVP as follows:

*A Power Apps system with the most important functionality. Employees can submit a rental request, the administrator can approve or decline it, and employees can easily view the status of their processed requests.*

The team defines the most usable product as follows:

*A Power Apps system with all components in place, where the application can also be integrated with Dataverse and PowerAutomate. The regular users and the administrator will receive notifications when there are updates on the requests. The system will also automatically generate and send contracts to the users. Proper documentation and organized low code will allow further development.*

The team aims to reach the minimum viable product and work towards the most usable product. The achievement of the defined goal can later be used to evaluate the work towards the end of development. The methodology used to achieve this goal, and quality assurance, will be presented in the next chapter.

### 3 Project management

In this chapter, the team will introduce the management in terms of methodology and various tools used for the process. Moreover, the quality assurance will be described and elaborated on. The chapter is divided into two subchapters. The first will present the methodology used. The second subchapter defines the quality of this project. It is divided into two sections describing the project's process and product quality, elaborating on how various elements will contribute to ensuring quality.

#### 3.1 Methodology

To ensure flexibility and customer focus, an agile methodology was applied (QualityLogic, n.d.). Working agile allows for a high level of flexibility and adaptability, which was necessary for this project, as the scope was vague at the project start. Also, this methodology is typically centered around the end user's needs, ensuring that the final product meets the customer's requirements (QualityLogic, n.d.). This has enabled the team to collaborate more efficiently while developing a high-quality system. The process is based on the four fundamental principles of The Agile Manifesto (The Agile Manifesto, 2001):

1. **Individuals and interactions** over processes and tools
2. **Working software** over comprehensive documentation
3. **Customer collaboration** over contract negotiation
4. **Responding to change** over following a plan

It was decided to use an iterative method (the agile method) to bring the project forward. The adopted methodology makes it possible to introduce the system to clients more frequently and to obtain input at every phase (Martins, 2022).

Additionally, an iterative process allows for consideration of ongoing needs and other improvements to the project (Martins, 2022). Like other agile approaches, Scrum aims to meet Product Owners' requirements by establishing an environment based on dialogue, shared responsibility, and continuous progress (Scrum Alliance, n.d). The project's anticipated change and growth during the development phase align well with the Scrum methodology. By delivering increments in each Sprint, Scrum

provides learning that can give reasonable revisions for the subsequent sprints (Deemer, 2010, p. 5).

## 3.2 Quality

With the client's and our supervisor's investment in the project, the team shared a common desire to provide a high-quality product in return. Quality can be divided into process and product quality (Wibas, n.d.). The team believes that focusing on both can be beneficial, as high-quality products often result from high process quality (Münch, Armbrust, Kowalczyk, & Soto, 2012, p. vii). The following sections will describe how this will be ensured.

### 3.2.1 Process Quality

According to Münch et al. (2012, p. 141), "If processes do not evolve with the development context and do not support developers in an adequate way, the resulting product quality often remains low.". A possible consequence of not having good process quality and an understanding of the processes' effects is not being able to repeat success (Münch et al., 2012, p. 141). Because of this, several measures will be taken by the group to ensure the process quality of the project. These measures will be presented in the following sections.

According to Stanleigh (2016), "By evaluating your plan for potential problems and developing strategies to address them, you'll improve your chances of a successful [...] project". Because of this, the team has implemented a risk assessment (Appendix 4) to enhance quality (Wilson, 2022). By identifying possible risks at an early stage, the team can work towards minimizing or even eliminating the risks. Additionally, the team believes that continuous dialogue with the project owners and the project supervisor will mutually benefit all involved parties.

Using Scrum artifacts and the four fundamental principles of the Agile Manifesto, the team will enhance its ability to adapt to any necessary changes (The Agile Manifesto, 2001). Using Scrum artifacts and events has enhanced process quality in previous projects throughout the bachelor's degree. The three artifacts used in this project are *Product Backlog*, *Sprint Backlog*, and *Product Increment* (Salimi, n.d.). This will ensure that the team has maintained control and overview. The events used



are *Sprint Planning*, *Daily Scrum*, *Sprint Review*, and *Sprint Retrospective* (Salimi, n.d.).

Sprint Planning is important to define what can be delivered in the sprint and how that work can be achieved (West, n.d.). The purpose of the meeting is to consider the different goals the team wants to achieve for the upcoming sprint (West, n.d.). The group selected the top priority elements from the backlog to accomplish during the sprint. Elements from the backlog are based on user stories, found in Chapter 4.2.2, giving the group insight into the user's demands. Furthermore, elements chosen from the backlog were separated into smaller sub-tasks. These were added to the Sprint Backlog, delegated to group members, prioritized, and estimated. The tool used to keep track of the backlog was Trello. A screenshot from the board can be found in Appendix 5. Planning of the sprints and the Sprint Review and Retrospective were documented in a shared document (Appendix 6), ensuring each team member could access it at any time.

Regular meetings are essential to help the development team control the workflow of a Sprint (Scrum Alliance, n.d.). Daily Scrum is something the team has implemented every day in the meetings. The purpose has been to inspect the progress toward the Sprint goal and adjust the Sprint Backlog if necessary (Scrum Alliance, n.d.). Each meeting began with everyone on the team giving an update on their progress since the previous meeting. The team discussed the project's status, development, difficulties, and future intentions. This was also documented in a shared document, which can be found in Appendix 7. Regular meetings have been carried out to ensure all team members are on the same page.

The purpose of a Sprint Review is to examine the sprint result and identify the next sprint adaptations (Scrum Alliance, n.d.). The team implemented this event by having meetings every other week with the Product Owner and the clients to discuss the progress. A system demonstration was held during the meetings, and the topics discussed were written into a shared document (Appendix 6). This ensured that the Product Owner and client could provide feedback, establishing trust between the team and the external parties.

A Sprint Retrospective focuses on inspecting the entire process within the team (Scrum Alliance, n.d.). The team included this event in the process after each Sprint Review. In these meetings, the team reviewed how the last sprint went regarding communication, interactions, and process. Difficulties were also addressed and reflected on. This feedback was written into a shared document (Appendix 6). Having a Sprint Retrospective will contribute to developing a process that may improve the quality and efficiency of the project.

### *3.2.2 Product Quality*

By ensuring a high-quality process, the team will be able to optimize the quality of the product (Münch et al., 2012, p.141). According to Indeed Editorial Team (2023), “Product quality refers to how well a product satisfies customer needs, serves its purpose, and meets industry standards.”. To ensure that the client would be satisfied with the final product, the team found it important to understand Ingeniørvesenet’s point of view of a high-quality system. During Sprint Reviews and start-up meetings with the Product Owners, specific requirements of the system were discussed. This resulted in an agreement on the initial scope. This way, the team can measure the quality inspection against Ingeniørvesenets’ requirements for quality.

Furthermore, the involvement of the end users will be an essential aspect of product quality assurance. This includes involving both the administrator and regular users in the development process. The team involved the administrator to the fullest extent to make the right adjustments to both applications. The team also conducted interviews and user testing with regular users and a final user test of the finished applications to ensure product quality. The data collection and system requirements will be presented in the next chapter. Whether the quality assurance has been achieved will be discussed in Chapter 7.

## 4 Analysis

The following chapter will first introduce the two types of data collection used in this project. Further, the methods used to accommodate system requirements for this project, including MoSCoW, user stories, personas, and FACTOR, will be shed light on.

### 4.1 Collection of data

The main sources of data collection have been interviews and user testing. The team had the opportunity to conduct interviews and user testing of three users, participants A, B, and C. The Product Owner was given requirements for the participants needed. After this, the team received three participants for interviews and user testing. This was immensely useful, as the users covered most of the target group of the application, which was the employees at Ingeniørvesenet. The ideal test group would have been more diverse. For instance, the team would have wanted to include all genders and a wider age range among the participants. However, this was unfortunately not possible.

#### 4.1.1 Interviews

The team conducted semi-structured interviews because they are flexible and adaptable (User interviews, n.d.). The complete interview guide can be found in Appendix 8. Conducting interviews is advantageous during the discovery phase since there is a possibility for uncovering new opportunities and generating new ideas (User interviews, n.d.). Two types of interviews were conducted: one for the regular users and one for the administrator. It was necessary to conduct two types of interviews, as the different roles of the system have different needs and areas of responsibility.

The team conducted the interviews to understand better how the application should take shape. It is important to get feedback from the future end users of the system (Francis, n.d.), as they might understand the application differently than the developers. The results of the interviews are presented in Chapter 5.1.

#### 4.1.2 User testing

According to Sandnes (2018, p. 291), user testing involves the acquisition of feedback on a design or a system from a panel of users. Mürsoo (n.d.) introduces a significant benefit of conducting user tests. Conducting user tests during the development phase can identify mistakes in the system at an early stage (Mürsoo, n.d.). This could reduce development costs, as “Fixing errors after launching a product can be 100 times more costly than doing so during development” (Mürsoo, n.d.). In this project, user testing has reduced the development time because the team was able to gain user insights at an early stage.

The team created two test scenarios for the participants (Appendix 13). All four team members were present during the user tests. This way, the team members could take on different roles (Sandnes, 2018, p. 297). One team member led the user testing, the second observed the users, and the last two took notes. Observing nonverbal cues, such as facial expressions and body language, is important because this usually provides the most accurate information about people’s thoughts and opinions (Ross, 2018). This gave the team a greater understanding of the users’ interpretation of the application’s logic.

During the user testing of the prototype, it was presumed that the participants' answers could be affected by their view of the application if they had seen it before the interviews. Because of this, the team conducted user testing after the interviews. This way, the team could get unbiased results from the interviews. It is essential to understand that the users may understand the system differently than the developers (Francis, n.d.). Because of this potential difference, important needs for the application may appear after conducting user testing, which will be discussed in Subchapter 5.2.

#### 4.2 System Requirements

The following subchapter will explain the methods for accommodating system requirements. Firstly, the system definition will be presented using the FACTOR method. Secondly, user stories developed are introduced. Further, the personas created are presented. Finally, the prioritizing of activities through the MoSCoW method will be explained.

#### *4.2.1 System Definition using FACTOR*

To develop a good system definition, the team has used the FACTOR method, which is an acronym for functionality, application domain, conditions, technology, objects, and responsibility (Mathiassen, Munk-Madsen, Nielsen, & Stage, 2018, p. 40). The method includes the most important elements in a system and represents an overall visualization of a system (Mathiassen et al., 2018, p. 40). The system definition, defined in collaboration with Ingeniørvesenet, is presented in Figure 5. The definition will be used to measure product quality, presented in Chapter 7.

FACTOR	Description
<b>Functionality</b>	Employees should be able to send in a rental request containing their requirements to the administrator. Further, the administrator shall be able to receive and process these requests
<b>Application Domain</b>	The regular users have the ability to register and view rental requests. The administrator has the ability to view and update the system, i.e. approve or decline a rental request.
<b>Conditions</b>	To this date, the administrator has registered vehicle rentals manually through an Excel sheet, resulting in an inefficient procedure. Ingeniørvesenet desires a digital application for the renting process to increase efficiency.
<b>Technology</b>	The system will be two application developed in Microsoft Power Apps and published as an application tab in their team, in Microsoft Teams. Dataverse is the technology used for the database.
<b>Objects</b>	The main objects of the system are the administrator, the regular users (employees at Ingeniørvesenet), and the vehicles being rented.
<b>Responsibility</b>	The system is responsible for conveying the users' needs to the administrator. Further, the system is also responsible for providing the users with the results of the requests (processed by the administrator).

Figure 5 - System Definition using FACTOR

As a result of the FACTOR method, the team has composed the following system definition:

*“To this date, the administrator at Ingeniørvesenet in Kristiansand Municipality has registered vehicle rentals manually through an Excel sheet, resulting in an inefficient procedure. Ingeniørvesenet desires a digital application for the renting process to increase efficiency. The applications will be developed in Microsoft Power Apps and use Microsoft Dataverse as the database. The system will be separated into two applications, which will be available to the administrator and regular users in an application tab in their team in Microsoft Teams depending on their access role. The employees will be able to rent vehicles by sending a rental request including the needed requirements to the administrator of the application for regular users. Meanwhile, the administrator will be able to view and update (process) the rental requests in the administrator application. Regular users will be able to view the result of the administrator’s response to the request.”*

### 4.2.2 User stories

By developing a system definition, the team gained a greater understanding of the system. To gain a further understanding of the requirement specifications, the team decided to create user stories based on this definition. The user stories will benefit the system, making the development process more efficient (DailyAgile, n.d.). Including "acceptance criteria" for the user stories was necessary because they are the basis for establishing whether a user story is sufficient (Pereira, 2022). The team sorted the user stories into priority order with the help of the MoSCoW method, which will be elaborated on in subchapter 4.2.4. One user story (Figure 6) was prioritized as the most important as it includes the most essential aspects of the system. The other user stories are presented in Appendix 9.

User story 1.1
<p><b>Demand:</b> As a <b>user</b>, I want to be able to send a rental request for a vehicle, through a computer application, so I can increase my efficiency.</p> <p><b>Activity:</b> Send a rental request for a vehicle through a form</p> <p><b>MoSCoW:</b> Must have</p> <p><b>Argument:</b> This user story is about the renting process for employees. The customer wants to make this process more fluent/effective than it is today. This will be the main functionality of the app, and therefore it has been prioritized as "must have".</p> <p><b>Criteria:</b> After a user has logged in to the app (through Microsoft Teams/Microsoft user), they will have the option to rent a vehicle. Further, the user will get an overview of the categorized vehicles. Then, the user chooses the desired category and they will specify certain criterias for their rental, such as renting period and specific criterias for the vehicles in question. Further, the user will see a summary of their order, and can choose to confirm this and send the request, or go back one step to edit the order. When the user clicks "Send forespørsel", they will get a pop-up that asks "Er du sikker?", or "Avbryt". If the user is sure they will get confirmation that the request has been sent. If they are unsure they will return to the summary.</p> <p><b>Test-scenario:</b></p> <ul style="list-style-type: none"><li>- Log in</li><li>- Choose "Innleie av maskiner"</li><li>- Choose the desired type of vehicle</li><li>- Choose specific criterias for the order in question</li><li>- Send the request</li><li>- (User gets asked if they are sure)</li><li>- Choose "Send forespørsel"</li><li>- (If the user is sure - gets a pop-up confirming a successful send-in)</li><li>- Choose "Ok"</li><li>- (User gets directed to "Mine forespørslar")</li></ul>


Figure 6 - User Story 1.1



### 4.2.3 Personas

The team continued developing personas based on user stories. Two personas were developed to gain a broader understanding and valuable insight into the different roles of the system. The persona for the regular user is presented in Figure 7, and the persona for the administrator can be found in Appendix 10. According to the Interaction Design Foundation (2022), “creating personas will help you understand your users’ needs, experiences, behaviors and goals.”. By developing two different personas, the team has gained a greater understanding of the roles in the system.

**Peter Andersen**



AGE 39  
EDUCATION Bachelor in construction engineering  
STATUS Married  
OCCUPATION Ingeniørvesenet  
LOCATION Kristiansand  
TECH LITERATE Low

**Bio**  
Peter lives in Kristiansand, and has been married for 11 years. He and his wife is currently planning to redecorate their house. He also has lot of construction project going on at work. Peter is not very technically competent, but is interested in learning more.

**Core needs**

- Need to be able to get an overview of his rental requests in a simple way.
- Need to be able to send rental requests to Admin efficiently
- Need to be able to specify requirements for the operator in regards to qualifications.

**Frustrations**

- Frustrated with how slow the rental process is today.
- Not being able to view his rented vehicles and their delivery dates.
- Having to call the admin to be able to rent a construction vehicle.

“ Measure twice, cut once!

**Personality**

Introvert Thinker Doer

Figure 7 - Persona for Regular User

#### 4.2.4 MoSCoW

After developing the system definition, user stories, and personas, the team prioritized activities using the MoSCoW method (Appendix 11). MoSCoW provides a straightforward method to sort and prioritize user stories according to relevance by Must have, Should have, Could have, and Won't have (Korolov, 2021). The team adopted MoSCoW based on previous experiences and knowledge of the method. Additionally, it is an excellent technique to use in agile methodology because it places the most value on the items that carry the highest business value (Lucid Content Team, n.d.). Prioritizing with MoSCoW means that the features identified as more valuable will have a higher priority in the development process (Lucid Content Team, n.d.). This method has been important for the team to establish an MVP as early as possible.

## 5 Findings

The following chapter aims to present the findings from the methods implemented during the data collection presented in the previous chapter. The chapter is segmented into two subchapters. In the first subchapter, the results from the interviews will be introduced. In the second subchapter, the results from user testing of the prototype will be presented.

### 5.1 Interview findings

Results from the interviews with three employees from Ingeniørvesenet gave the team new insights and a greater understanding of the target group. A detailed description of the findings can be found in Appendix 12. The findings show that all three participants find the current system time-consuming and inefficient. They seek a more uncomplicated and straightforward solution that is easy to use and understand. According to the participants, a digital application would be the most suitable alternative. The participants believe that an application will save time and make the renting process more systematized and user-friendly. Nonetheless, the most significant difficulty with the implementation could be the users' concern and familiarity with a new system. The team acknowledges this feedback and will consider it in the ongoing development of the application. This has been done by including design principles in the development phase, which will be elaborated on in Chapter 6.

### 5.2 User testing findings

The results of user testing the prototype led to interesting findings. A detailed description of the findings can be found in Appendix 13. Firstly, the findings show that all participants found navigating the application straightforward. However, there was some variation in their understanding of where to navigate for specific tasks. For instance, one of the participants encountered difficulties in interpreting the navigation to the home page, while the other two found it intuitive. Furthermore, one participant had difficulty comprehending the "Mine forespørslar" page. This is an aspect that the team must consider while continuing to develop the application in Power Apps. This will be done by making adjustments in the design to make the page more intuitive. Lastly, all three participants expressed their admiration for the application's design and functionality. They also communicated their desire for additional features, such

as email notifications for approved requests. The team had previously discussed this functionality when deciding the scope, but it was decided not to include it in the MVP.

## 6 Design

The following chapter explains the design process deployed in the project. This chapter is divided into two subchapters. In the first subchapter, the technologies used in the project and how further development has been facilitated will be introduced. The second subchapter presents the user interface. Further, the team will elaborate on the rationale and methodology behind generating sketches, wireframes, and the prototype. Some of the underlying design principles that affected the development of the interface will also be explained. The user experience will also be presented, highlighting the significance of universal design in the applications.

### 6.1 Technology

The application was developed in the Microsoft Power Platform. This low-code platform enables organizations to create custom business applications, automate processes, and analyze data (Microsoft 3, n.d.). Low-code is an approach to development that uses minimal hand-coding to enable faster delivery of applications (IBM, n.d.).

#### 6.1.1 Power Apps

Power Apps is a data platform that provides a development environment for building custom apps for business needs (Microsoft 2, 2022). With Power Apps, developers can build apps that connect to data stored in the underlying data platform (Dataverse) or various online and on-premises data sources, such as Sharepoint (Microsoft 2, 2022). Although Power Apps is low code, it was necessary to do some programming to add functionality to the app. The language used for this was Power Fx. This is a low-code language that can be used across the different components of Microsoft Power Platform (Microsoft 1, n.d.). According to Microsoft (1, 2023), Power Fx is a “[...] general-purpose, strong-typed, declarative, and functional programming language.” This means that the language is easier to understand and allows for early detection of errors while authoring (Microsoft 1, 2023).

#### 6.1.2 Dataverse for Teams

Dataverse is built on Azure and is, according to Microsoft (4, 2022), “[...] globally available, compliant, scalable, and secure.”. Dataverse for Teams was selected as the database for the Power Apps applications. The team chose this because it is

easy to manage, and it was a quick setup process (Microsoft 5, 2022; Valto Microsoft Solution Partner, n.d.). Dataverse was also very useful regarding data types. For instance, a lookup field was used for one of the columns. By doing this, the field displayed in Power Apps automatically became a drop-down of all contact persons with the possibility to search for and select the desired person. Creating the drop-down fields would have been more time-consuming with other options.

Furthermore, using Excel as a data source was considered. However, this was quickly excluded, as it has significant limitations. For instance, users cannot use the app if the Excel sheet is open on another computer. Additionally, using Dataverse enabled employing existing Dataverse columns of the Product Owner's internal Teams. Using a Sharepoint List as a data source was also considered. However, the Dataverse solution appeared superior, as it is more efficient.

### *6.1.3 Facilitating further development*

After delivering the product, Ingeniørvesenet can develop the system further. The group views that the next natural development step is creating Power Automate flows. The flows should automate notifications to both the users and the administrator. Notifications are a function integrated into Power Automate (Microsoft 6, 2023). A notification should be sent to the administrator when a new record appears in the database after a user has sent in a new rental request. Additionally, the user should be notified when the administrator has processed the rental request within the application. The notifications could go by email or regular push notifications on mobile devices. Furthermore, additional functions can be added to enhance the user experience. These are presented and prioritized through user stories in Appendix 9.

## **6.2 User Interface**

This subchapter will present the user interface. The first section presents the design process, including sketches, wireframes, and the prototype. The second section will elaborate on how some of Benyon's design principles have impacted the development of the user interface. Lastly, the final section will present considerations regarding the user experience and universal design.

### 6.2.1 Design process

Concerning the design process, the project team created navigation maps, sketches, wireframes, and an interactive prototype. Visualizing how the pages would interact, was necessary to get an overview of the system. Therefore, the team started by creating navigation maps for the regular user and administrator applications. The navigation maps can be viewed in Appendix 14 and 15.

Two team members used the Goodnotes 5 application on their tablets to create the sketches, as shown in Figure 8. These can also be found in Appendix 16 and 17. The sketches provided a solid foundation for the following design stages. The team started developing wireframes when the sketches were almost complete (Figure 9). Creating wireframes serves several purposes, including speed, ease of creation, and defining and clarifying the system features and architecture (Svetolikovic, 2018).

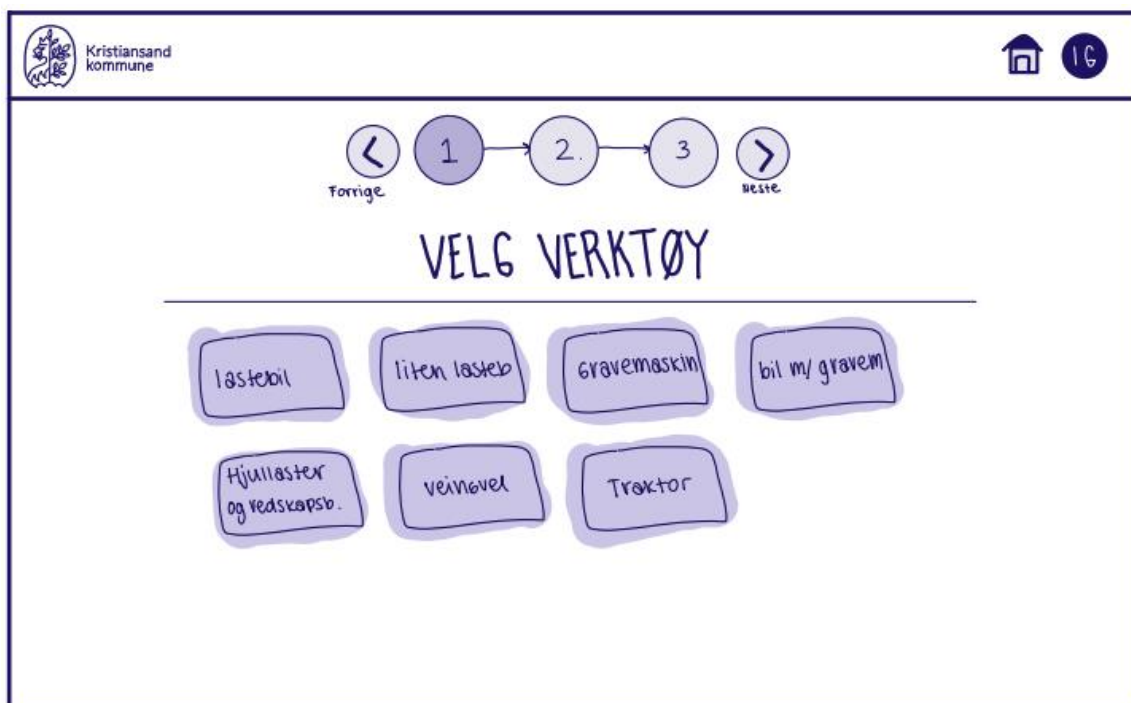
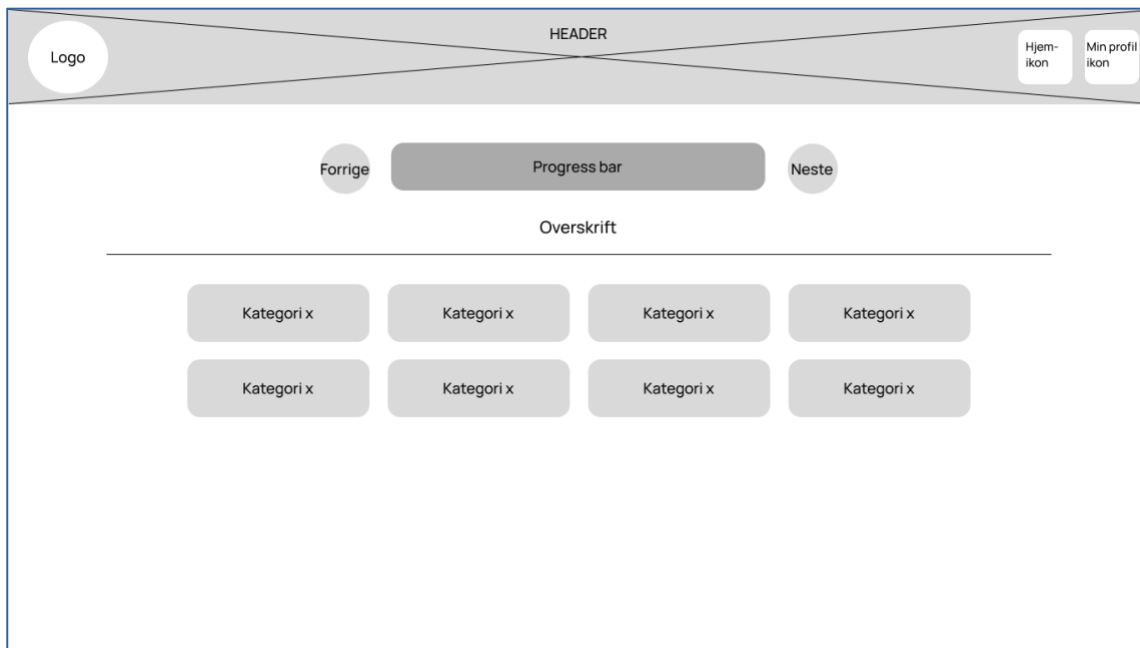


Figure 8 - Sketches for the "choose category" - page for regular users



*Figure 9 - Wireframe for "choose category"- page for regular users*

Upon the Product Owner's approval of the sketches and wireframes, the team progressed to creating an interactive prototype using Figma. The primary objective for developing a detailed and fully functional prototype was to allow user testing. This was facilitated by Figma's capacity to incorporate prototype functions. The prototype for the regular users can be found in Appendix 18 and the prototype for the administrator can be found in Appendix 19.

### *6.2.2 Design Principles (UI)*

According to Rosala (2020), "Product design principles [...] are value statements that describe the most important goals that a product or service should deliver for users and are used to frame design decisions". Therefore, to ensure an optimal user interface throughout the design process, the team followed Benyon's 12 design principles. Figure 10 shows how the principles are categorized into three distinct categories: learnability, effectiveness, and accommodation. The team has considered all principles when creating the user interface. However, during the collection of data, the team learned that the end-users of the applications were not technically savvy (Subchapter 5.1). Because of this, the team decided to focus on the most important principles for securing effectiveness and learnability. The principles in focus were **consistency, control, navigation, recovery**, and



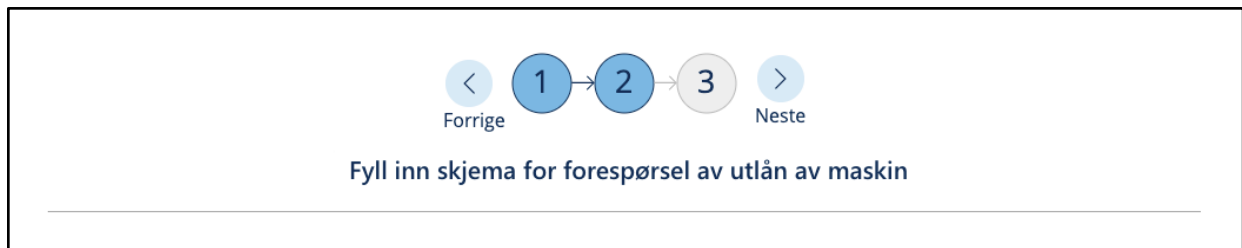
**constraints.** The following sections will elaborate on these principles and their associated examples from the applications.



*Figure 10 - Benyon's 12 design principles (Benyon, 2019, p.116-117)*

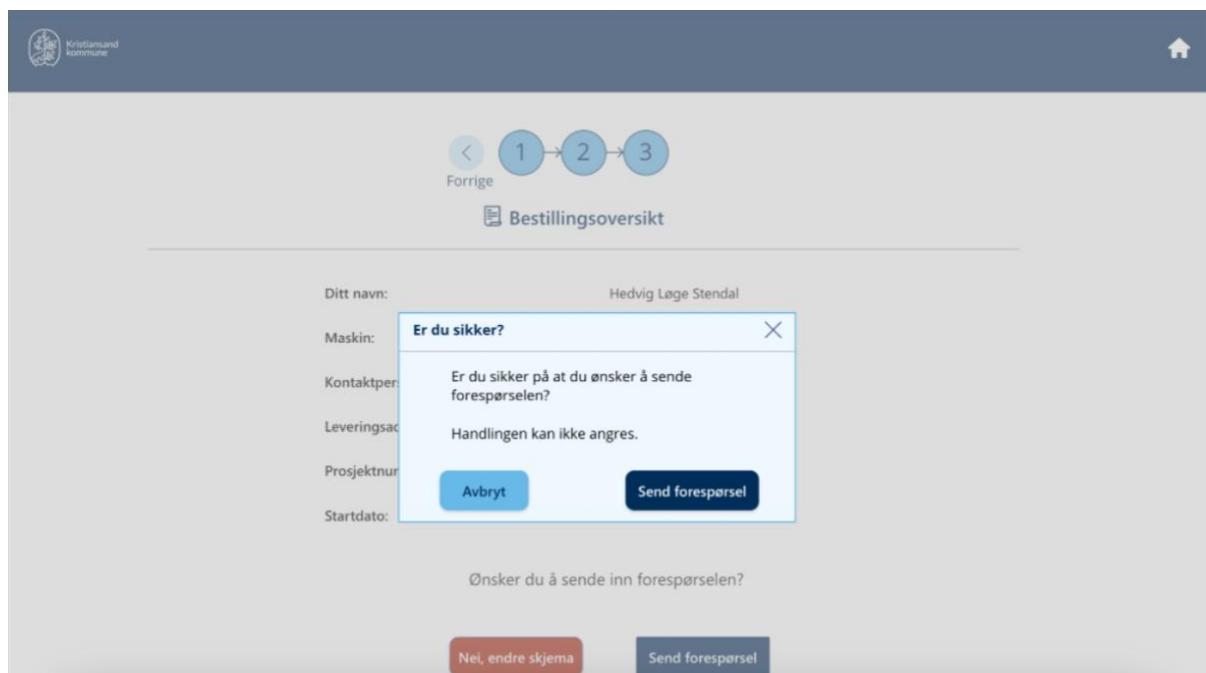
One of the learnability principles is **consistency**, which implies that the designer should maintain uniformity in design features and system functionality (Benyon, 2019, p. 117). The team has followed this by ensuring that the home button consistently appears in the top right corner and that the headlines are consistently positioned on every page. In addition, the header appears uniformly across all pages.

A principle from the effectiveness category is **control**. This principle indicates that the design must enable the users to recognize areas where they can take control, while also ensuring logical mapping between controls and their potential outcomes (Benyon, 2019, p. 117). One example of this principle is the progress bar (Figure 11). The progress bar is particularly advantageous for several reasons. Firstly, it enables users to monitor their current position in the process. Secondly, it creates easy navigation between the steps by pressing the previous or next buttons to go back or proceed. The progress bar also aligns with the **navigation** principle, which seeks to give users a sense of control when navigating through the app (Benyon, 2019, p. 117).



*Figure 11 - Progress Bar for the rental request*

The team has also considered the **recovery** and **constraints** principles when developing the applications. The findings from the conducted interviews (Chapter 5) indicate that most of the users do not consider themselves to be technically competent. Therefore, it has been essential to design applications that allow for recovery from actions and provide constraints to prevent the user from making any inappropriate actions. Figure 12 shows that a pop-up message will appear when a regular user attempts to submit a rental request. This requires the users to confirm their request before proceeding. The pop-up prompts users to double-check their actions before finalizing any activities that may result in unintended consequences. Also, the progress bar always allows the user to go back to the previous step in the rental process, ensuring recovery in the application.



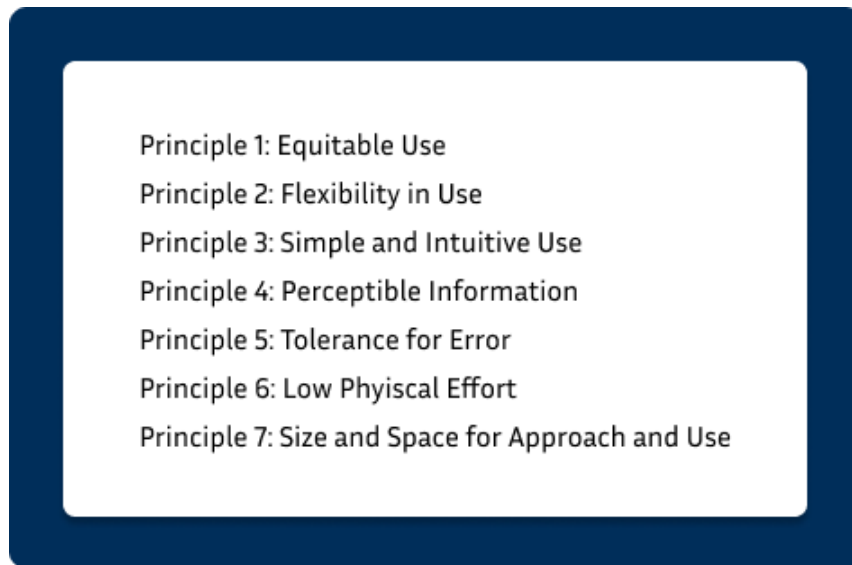
*Figure 12 - Pop-up when submitting a rental request*

### *6.2.3 User Experience and Universal Design*

According to Nielsen and Norman (n.d.), user experience “[...] encompasses all aspects of the end-user interaction with the company, its services, and its products.”. The team desires to make the system user-friendly and efficient to give the end-user a good experience. To provide as many as possible a good user experience, the team has considered Universal Design principles. The Centre for Excellence in Universal Design (1, n.d.) defines Universal Design as “[...] the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability”. There are two main reasons why the team chose to consider Universal Design in the design process.

Firstly, by incorporating Universal Design principles with UX in the design process, the team aims to make the app intuitive and accessible for all employees at Ingeniørvesenet. Norway has legal requirements for products and services (UU Tilsynet, n.d.) that follow the Web Content Accessibility Guidelines (WCAG). This set of guidelines explains “[...] how to make web content more accessible for people with disabilities” (Web Accessibility Initiative, n.d.). The team has followed these by considering contrast levels, font sizes, and color choices.

Secondly, the team has designed with the seven Universal Design principles (Figure 13) in mind (Centre for Excellence in Universal Design 2, n.d.). All the principles have been important. However, some of them have been given higher priority for various reasons. For instance, the team has designed the system to contain perceptible information, which is the fourth principle. This means the system should use different modes to present essential information and provide sufficient contrast to make essential information visible (Centre for Excellence in Universal Design 2, n.d.). This has been an important principle to ensure that visually impaired employees can use the application.



*Figure 13 - The seven Universal Design Principles (Centre for Excellence in Universal Design 2, n.d.)*

As mentioned, the team learned that the system's end-users do not see themselves as technically savvy. Therefore, the fifth principle has been important during the design process. The team has tried to arrange the elements in a way that minimizes error and provides warnings of troublesome situations (Centre for Excellence in Universal Design 2, n.d.). For instance, by providing popups when the regular users submit a rental form (Figure 12). According to UU Tilsynet (n.d.), this results in higher user satisfaction, making the app usable and enjoyable for everyone and increasing user satisfaction and loyalty. The next chapter will elaborate on the team's assurance of quality.

## 7 Quality assurance

In the following chapter, the team will present the quality assurance measures taken throughout the project, focusing on the modifications implemented after analyzing the findings presented in Chapter 5. The team will provide an overview of the adjustments made based on the test results, highlighting how high quality in the final product was ensured.

### 7.1 User Testing

After analyzing the findings from the interviews and user testing, some modifications were made to ensure product quality. First, the feedback from the interviews with employees at Ingeniørvesenet highlighted the need for an uncomplicated solution (Appendix 12). The team has included design principles in the development phase to ensure the system is user-friendly and intuitive (Blue Sky Graphics, 2022). Secondly, as mentioned in Chapter 5, the results from the user testing of the prototype showed that there were some navigation issues the team needed to address to improve usability. Because of this, the team decided to make some adjustments to the design. One example of this is changing the color of the home icon from light blue to white (Figure 14). Additionally, after the feedback, the team prioritized new tasks into the MoSCoW prioritization list. One example is adding necessary functionality to make it possible for the regular users and the administrator to sort rental requests by status.



*Figure 14 - Illustration of change in home icon design*

## 7.2 Results

As mentioned in the previous subchapter, the team made changes to ensure that the requirements for quality (established in Chapter 3) would be accomplished. The first section will explain the results of these changes regarding the product. The second section explains the result of the process of quality assurance.

### 7.2.1 The Product

The quality of the applications was planned and defined from the beginning to ensure that the product fulfilled the client's expectations. As mentioned in Chapter 3, the team planned to involve the end users as much as possible in the development process. Involving them helped the team understand Ingeniørvesenet's point of view on product quality throughout the development process. The team received feedback during each Sprint Review, ensuring the team was on the right path in product development. After finishing the applications, the team conducted a final user test on the Product Owners, including the administrator. Conducting user tests of the final product shows that the adjustments made after the initial user tests have been beneficial. These tests worked as a quality inspection against the system definition made in collaboration with Ingeniørvesenet (Subchapter 4.2.1).

Another method used to ensure product quality was pair programming. Pair programming provides several benefits, such as higher-quality code and collective ownership (Shakebugs, n.d.). The team holds the view that this has increased the quality of the code. Further, this has resulted in all team members feeling a sense of ownership of the code produced. The team found that pairing up to write code, a practice known as pair programming, made us more confident in our solutions. This is supported by a study by Rickhard Dahlstrom, which found that 95% of developers also reported increased confidence when pair programming, as referenced in Shakebugs (n.d.).

Loose coupling combined with high cohesion are also principles the team has followed to avoid hard coding and ensure a dynamic application (Panigrahi, 2022). One example of following these principles is when creating the rental form in the application. The form adjusts to the individual rental process based on the chosen

vehicle, making it dynamic. The team wanted to ensure minimal dependencies to make further development more accessible and easier to maintain (Gadzinowski, n.d.). Furthermore, loose coupling and highly cohesive design have reduced the system's complexity (Comartin, 2021). This has contributed to ensuring the quality of the product. The Product Owners expressed gratitude and admiration for the final product. All three found the system intuitive and pleasant. Based on the feedback from Ingeniørvesenet, the team considers the requirements from the system definition fulfilled.

### *7.2.2 The Process*

To ensure process quality, the Agile Manifesto for software development was followed, combined with the Scrum events (Appendix 6). For instance, Sprint Planning allowed the team to define what could be delivered in the upcoming sprint and how the team could achieve it. During the first Sprint Planning, the first Scrum Master was selected. The role of the Scrum Master has been to ensure productivity and close collaboration with the Product Owners and client (Becker, 2022). Moreover, the daily Scrum meetings and Sprint Retrospectives have secured a good process quality in several ways. For instance, the team members communicated easily, asked questions, and clarified uncertainties. Additionally, the meetings have made it possible to address issues regularly, which has made it possible to handle conflicts at an early stage.

Furthermore, Sprint Review has formed a close collaboration with the client and Product Owners. This collaboration has been a part of ensuring high process quality by having regular meetings. This has established good routines and continuous involvement of the Product Owners. Additionally, conducting Sprint Retrospectives allowed the team to control the sprint workflow, examine the sprint result, identify the next sprint adaptations, and inspect the entire process within the team. During the first two Retrospective meetings, the team discussed if it was necessary to point out a new Scrum Master. Due to the successful outcome with the first two Scrum Masters, the team chose to continue switching between them. Inspecting and evaluating each sprint during retrospective meetings made it possible to identify changes that could have been incorporated for the following sprint.

## 8 Reflection

The following chapter will describe and reflect on decisions that have been made throughout the entire project. It will also cover the challenges faced during the project's development and the choices used to overcome them. Lastly, how these factors affected the project's overall progress and potential improvements in how we could have managed them will be reflected.

### 8.1 Process

This subchapter will reflect on the key processes that influenced the project's outcome. First, we will introduce the importance of Sprint Planning and how each sprint was managed. Furthermore, we will discuss the associated difficulties that arise during the first Sprint. The resulting consequences, along with potential methods to avoid them in the future, will be presented. We will also provide insight and learning outcomes that will be a benefit in further team projects. Lastly, we will discuss the value of user stories and how they affected effective collaboration in achieving project success.

#### *8.1.1 Sprint Planning*

From past encounters with Scrum artifacts and events, each team member has acknowledged the importance of Sprint Planning. The Trello board (Appendix 5) visualizes eight sprints, each containing specific tasks and time periods.

We were able to break down the project into smaller and more manageable tasks for each sprint. The planned tasks and time periods for each sprint provided reassurance that the project could be completed within the given period. However, the flexibility of the agile approach meant that unexpected tasks could affect the already established sprints. For instance, during the first sprint, multiple sketches and user stories were intended to be created within a time limit. During the first Sprint Review meeting with Ingeniørvesenet, it became apparent that there had been some misunderstandings regarding the system's functions and the users' needs. The consequences of this misunderstanding were significant. Firstly, it required a reassessment of the system. Secondly, we had to dedicate more time to clarifying



what the user's actual need was. The result was that all the user stories needed to be changed and redefined. Lastly, it was necessary to develop new sketches that led to a new prototype. As a result of this misunderstanding, we spent 57 hours during sprint 2 making adjustments. However, as mentioned, the flexibility of the agile approach allowed for sprint tasks to be moved to the next sprint.

Looking back, the misunderstanding could have been avoided with better communication from the start. To address this, we early established a document where we could write down questions that arose during the development process. We went through this document a few days before each Sprint Review meeting. It was also established which team members should ask the questions, take notes, and observe. This approach enabled all team members to understand the upcoming sprint's tasks clearly.

Fortunately, we discovered the misunderstanding during Sprint 1. It taught us a valuable lesson about the importance of communication in team projects. After this, we improved internal and external communication by focusing on having a common understanding of the scope.

### *8.1.2 Prioritizing*

Throughout the project, prioritizing has been important to ensure that the system's most important requirements are implemented. For instance, we have used MoSCoW to prioritize user stories and features. The process of creating user stories was vital to understand the most important features of the applications.

It was important to have detailed discussions on each MoSCoW-priority to prevent misconceptions. Ultimately, we agreed that the must-have user stories should mainly focus on functionality vital for the application's MVP. The challenge when writing the user stories was to be concise and limit the stories to hold one requirement at a time. According to Pereira (2020), "[...] when adding multiple requirements to a User story, we do just the opposite". Therefore, we ensured that each user story only represented a single requirement. This proved to be valuable for the team and the project. Each user story became a milestone that we could work towards. By

regularly checking our progress against the user stories, we were able to stay focused on our goal. This approach helped us see improvement, which resulted in a motivated and supportive atmosphere in the team.

Looking back, an alternative approach could have been to engage the users earlier in the process. For instance, conducting interviews with the users first and then creating the user stories based on the insight gathered. After that, we could have followed up with user testing. This approach could have helped us to accurately capture the user's needs and requirements for the system earlier in the process. In summary, creating user stories was an effective way to track our progress and bring clarity to our team's goals.

## 8.2 Architecture

In this subchapter, we will reflect on the technical expertise required for building an application using Microsoft Power Apps. This includes the limitations and challenges that come while transitioning the system from static to dynamic. In addition, we will reflect on the impact of these decisions for the final product.

### 8.2.1 *Technical expertise*

The team was determined to create an application that met the requirements of the project description (Chapter 4.2.1). To accomplish the MVP, a thorough understanding of the platform was fundamental. Therefore, everyone engaged in a learning process by completing several Microsoft courses related to the Power Platform technologies.

All team members explored topics related to Microsoft Power Apps, from basic features to more advanced techniques. Additionally, each person learned how to connect other Microsoft services, such as Dataverse and Sharepoint, into our application. We experimented with different features and functions of the platform until we understood how the platform worked.

We found that learning through trial and error was the most effective way to understand the platform better. Further, we have experienced that the key benefit of trial and error is that it has encouraged experimentation and creativity within the team. This also allowed us to learn from our mistakes. We believe that the freedom to explore and try out different ideas is more likely to come up with better solutions.

We could have improved the learning phase by adopting a more structured approach to learning. According to Westhoff, Koele, and van de Groep (2020), "[...] learning from other people's mistakes and successes is more efficient than figuring things out on our own.". We could have delegated topics to study so that we could learn from each other rather than learning all elements ourselves. That could have reduced the hours spent learning all the Power Apps concepts.

### *8.2.2 Limitations in Power Apps*

At the start of the developing phase, we discovered that developing an application in Power Apps can be a challenging experience due to its limitations. One of the most significant limitations is that only one person can work on the same application at a time. The solution was booking a meeting room to connect the computer to a TV screen, so everyone could contribute to the development process. The positive effect of this solution was that it ensured everyone was on the same page.

We did, however, have some difficulties with this solution. We experienced collaborating in this way as challenging and time-consuming. Everyone had to be patient when watching one person develop in Power Apps, and it was easy to become passive. Everyone had opinions on how different problems could be solved, which led to frustrations. This was discussed in the Sprint Retrospective in Sprint 3. A solution to this problem was to implement a rule that only one person at a time could present their thoughts about what could be the solution. In addition, we decided to work for 45 minutes and then switch so that another team member could share their screen. Later, another solution was discussed to increase the project's efficiency. This solution included delegating the tasks so that 1-2 team members could develop in Power Apps. Meanwhile, the other two group members could be efficient by completing other work, such as preparing interviews and user testing.

At the end of Sprint 3, we realized that making copies of the application was possible so that multiple group members could work on solutions. Making copies could have enhanced productivity regarding development. However, at that moment, we had already decided to start developing a separate application for the administrator. We could work more effectively due to being able to split up the team to work on both applications.

In conclusion, while Power Apps can be a valuable tool for developing applications, it has limitations and difficulties. Not being able to develop multiple people at the same time had a negative impact on both group collaboration and efficiency. We have also learned the significance of listening to each team member's input and ideas, which can lead to better outcomes.

### *8.2.3 Adjusting from static to dynamic*

At the beginning of the project, the application was more static. Each vehicle had its own rental form. However, throughout the application's development, we realized that we needed to make some changes to make the system behave more dynamically, so we gathered all the forms into a common form. It was essential to make this change to avoid hard coding of each form. If we had kept the system static, it would have complicated the system's maintenance. Continuing down the static path would also have led us to make separate "Bestillingsoversikt"- pages belonging to each rental form. A static approach would also complicate further development because the developer would have to implement new pages and functionalities for each new vehicle.

The consequence of switching to a more dynamic approach, however, was that we had to adjust our Sprints to accommodate the new behavior of the system. We also had to readjust our project timelines and make adjustments to deliver a high-quality product on time. As a result of this change, we spent 50 hours during Sprint 3 to make the system more dynamic.

The change to a dynamic system significantly impacted our group's ability to readjust. In a process that involves changes like shifting from a static to a dynamic

system, we experienced both benefits and disadvantages with the Scrum methodology. One of the key advantages was that Scrum allowed us to adjust our plans and processes to accommodate the new requirements of a dynamic system without compromising the quality. However, we had to redefine the Backlog when the project requirements changed since several tasks had become irrelevant. Prioritizing and estimating the new tasks' time and complexity became challenging and time-consuming. Although this process was time-consuming, it was an important occurrence for us. We now have valuable experience in being agile and adaptable, for instance, dealing with unexpected changes and readjustment.

In retrospect, there are things we could have done differently to avoid this change in the middle of the development phase. The primary adjustment we could have made is doing more research at the beginning of the project. For instance, we could put more effort into identifying what a system like this requires and investigating different approaches to developing similar systems. We believe that transitioning from static forms to a dynamic form application improved the efficiency and effectiveness of the system. Overall, this change proved that the agile approach is beneficial when unexpected adjustments need to be handled. This allowed the team to be flexible and made it easier to adapt to changes, which was why the agile methodology was chosen. Finally, the team has conducted an evaluation, which can be found in Appendix 20.

## 9 Conclusion

In conclusion, the project for Ingeniørvesenet, which aimed to digitalize their manual rental service process, was successfully completed. The team developed the applications through Power Apps in Microsoft Power Platform, following the Agile Manifesto principles and using Scrum artifacts and events. Collaborating with external parties, Atea and Ingeniørvesenet, the project involved thorough research, user testing, and design principles to ensure a high-quality product. Despite some challenges, the team delivered a compatible system, achieving the goal of providing an MVP. Furthermore, the team went beyond the initial project requirements by adding more functionalities to the application. The team improved the user experience and provided a more comprehensive solution for Ingeniørvesenet compared to the current solution. These achievements demonstrate the team's dedication and willingness to exceed expectations. Overall, this project served as an opportunity to apply the skills and knowledge acquired throughout the bachelor's degree in a real-world project setting.

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## Appendices

### Appendix 1 - Project supervisor statement



#### **Bachelorprosjekt våren 2023 – uttalelse fra oppdragsgiver**

Våren 2023 har Hedvig Løge Stendal, Ingebjørg Gregersen, Karoline Hamre og Eigill Vonen utført bachelorprosjekt innen IT og Informasjonssystemer hos ATEA avd. Kristiansand. I bachelorprosjektet har studentene jobbet på et prosjekt og representert ATEA som IT-konsulenter for en lokal kunde av ATEA, Ingeniørvesenet i Kristiansand Kommune. Prosjektet har gått ut på å kartlegge, designe og utvikle en applikasjon som vil øke produktiviteten, effektivisere og digitalisere prosessen for Ingeniørvesenets innleie av maskiner og utstyr.

Utførelsen av prosjektet har bestått av jevnlige samlinger hos ATEA på våre kontorer i Kristiansand, jevnlige møter med kunden og digitale møter ved behov. Som et resultat av dette har studentene utviklet et produkt bestående av to applikasjoner. Applikasjonene er utviklet med Microsoft Power Platform teknologien Power Apps, Power Fx og Dataverse for Teams. Produktet består av følgende applikasjoner:

- Innleie av Maskiner
- Administrator for Innleie av Maskiner.

Jeg opplever studentene som imøtekommende, lærevillige og selvdrevne. De gir inntrykk av å ha hatt et godt og velfungerende samarbeid innad i gruppen. De har vært flinke til å stille spørsmål til både meg og kunden når noe har vært uklart eller det har oppstått utfordringer underveis.

I utviklingen av produktet har studentene tilegnet seg verdifull kunnskap innen Microsoft Power Platform - teknologi som i økende grad blir etterspurt av våre kunder. Applikasjonene i prosjektet har blitt bygget i Power Apps. Programmeringsspråket som er benyttet er Power Fx og datamodellen er bygget i Dataverse for Teams.

Studentene har opptrådt profesjonelt i møter med kunden og de har levert et solid produkt som kunden er fornøyd med og som vil settes i produksjon og tas i bruk av Ingeniørvesenet. Kunden og vi i ATEA er svært tilfreds med innsatsen og produktet studentene har levert i løpet av prosjektet og ønsker dem lykke til videre!

*Undertegnende har fungert som overordnet prosjektleder og tech lead for studentene.*

Med vennlig hilsen

Ingvild Tisland

ATEA

## Appendix 2 - Project owner statement

Kristiansand kommune inngikk ekstern rammeavtale i 2020 om «innleie av biler og maskiner» (anleggsmaskin-entreprenører). Rammeavtalen er inngått med over 30. ulike maskin-entreprenører og er oppbygget med Excel-lister, hvor entreprenørene rangeres etter forhåndsdefinerte preferanser og vektinger. Ved avrop fra rammeavtale, er avtalen utformet slik at det kun er *en* kommunal representant oppnevnt med myndighet til å foreta avrop. Dette betyr at all intern og ekstern kommunikasjon foregår kun via «innleieansvarlig». Ved avrop tegner innleieansvarlig kontrakt med entreprenør basert på en intern forespørsel for en definert tidsperiode. Avtalens oppbygning har utløst et behov for et digitalt system eller plattform for intern saksbehandling/kommunikasjon mellom interne oppdragsgivere og «innleieansvarlig».

Bachelorgruppen har derfor fått oppdrag fra Kristiansand kommune, om å løse den overnevnte og spesifikke komplekse løsningen relatert til gjeldende rammeavtale for «innleie av eksterne biler og maskiner»

Gruppens medlemmer har under hele prosjektet vært særdeles oppfinnsomme, løsningsorienterte og fokuserte på å løse gitt oppgave.

Vi er henrykt og fasinert over resultatet som er avlevert til Kristiansand kommune. Deres bidrag til et lettfattelig system for håndtering av interne forespørsler om innleie vil danne et solid fundament for rammeavtalen, og er med på å danne en fremtidig videre utvikling av løsningene for å håndtere de mange og liknende problemstillingene i vår organisasjon.

Vi er særdeles imponert over den vilje og beslutsomhet som er nedlagt av alle gruppens medlemmer, for å påse at måloppnåelse og at prosjektet kunne realiseres og driftsettes i vår organisasjon.

Med vennlig hilsen,

**Andreas Almedal**

Ingeniørvesenet – Produksjon - Fellestjenester

## Gruppekontrakt

Dato: 9. Januar 2023

### Gjelder for følgende medlemmer:

Hedvig Løge Stendal, Ingebjørg Gregersen, Eigill Kristiansen Muruvik Vonen og Karoline Hamre


### Forventninger:

- Gruppemedlemmer skal møte presist til alle avtalte møtetidspunkter
- Forfall eller forsinkelser meldes på melding/telefon til gruppen.
- Vi noterer ned bøter for å komme for sent. 2 kr per minutt over tiden.
- Vi deler eventuelle kostnader.
- Taushetsløfte innad i gruppa, dette gjelder både arbeidsmessig og privat informasjon som måtte komme frem under samarbeidet i gruppa.
- Gruppemedlemmer skal møte med nødvendig utstyr til alle møter.
- Gruppemedlemmer skal bidra til prosjektet i like stor grad, og arbeid skal fordeles likt.
- Gruppemedlemmer er forpliktet til å produsere originalt innhold. Ingen kopiering er tillatt.
- Gruppemedlemmer er forpliktet til å dele sin mening og også lytte til andre gruppemedlemmer.
- Gruppemedlemmer skal oppføre seg profesjonelt og modent i argumenter.
- Gruppemedlemmer skal alltid vise de andre medlemmene grunnleggende respekt.
- Hvis et medlem av gruppen ikke er villig til å samarbeide og bryter reglene, vil de motta to advarsler før de ikke lenger kan være en del av gruppen.

Vedtatt og signert av følgende gruppemedlemmer den 9. Januar 2023:

  
Hedvig Løge Stendal

  
Ingebjørg Gregersen

  
Eigill Kristiansen Muruvik Vonen

  
Karoline Hamre

## Appendix 4 - Risk assessment

Risiko	Sannsynlighet (1-5)	Konsekvens (1-5)	Risikonivå	Risikopons	Håndtering
Langvarig sykdom	1	4	4	Akseptere	Fordele personens arbeid til de andre på gruppen
Mild sykdom	5	1	5	Akseptere	Hjemmekontor om mulig
Kommunikasjonssvikt i gruppen	2	4	8	Unngå	Skal møtes/snakkes 4-5 dager i uken + daily scrum + sprint retrospective
Kommunikasjonssvikt med Atea	2	4	8	Unngå	Gi beskjed dersom det er tendenser til det (begge parter)
Dårlig moral innad i gruppen	3	3	9	Unngå	Motivere hverandre, snakke sammen
Glemmer å lagre progresjonen i Power Apps	3	5	15	Unngå	Lagre kontinuerlig
Gruppemedlemmer får for lite søvn	4	2	8	Begrense	Eget ansvar å få nok søvn, men kan tilrettelegges ved spesielle behov
Gruppemedlemmer blir overarbeidet	2	3	6	Begrense	Ta hensyn til hverandre, og hjelpe hverandre
Gruppemedlemmer sporer av i gruppemøter	5	2	10	Begrense	Kommer til å skje, men skal slås ned på med en gang
Produktet møter ikke produkteiers krav	2	5	10	Unngå	Kvalitetssikring, MVP, MoSCoW, tydelig scope
For få pauser i arbeidet	4	2	8	Begrense	45-15-metoden. 45 min arbeid og 15 min pause.
Dårlig prioritering av funksjoner	2	4	8	Unngå	MoSCoW-prioritering
Bruke for mye tid på administrativt arbeid	3	1	3	Begrense	Gjøre det så enkelt som mulig



## Appendix 5 - Trello Board

### Pre-sprint - Sprint 4

The screenshot shows a Trello board titled "Bachelorprosjekt Atea" with a background of a snowy mountain range. The board is organized into five columns representing different sprints:

- Pre-sprint / 6. -20. januar**: Contains six cards with priorities ranging from "Høy" to "Lav". Tasks include planning meetings, learning Power Platform fundamentals, creating app makers, planning interviews, testing in Power Apps, and preparing Excel sheets.
- Sprint 1 / 23.jan-3.feb**: Contains five cards. Tasks include navigation map, user history, mobile/web mockups, sketches, and MoSCoW-lists.
- Sprint 2 / 6.-17. feb**: Contains five cards. Tasks include MoSCoW-list updates, sketches for super and regular users, regular user mockups, an interview guide, and regular user sketches.
- Sprint 3 / 20.feb-3.mars**: Contains seven cards. Tasks include starting the Power Apps front page, planning database tables, creating a database, setting up a "home" page, completing database tables, and creating categories for "lastebil".
- Sprint 4 / 6.mars-15.mars**: Contains six cards. Tasks include user testing, interviews with regular users, admin persona creation, regular user persona creation, PA functionality between pages, and creating "bestillingsoversikt" and "Product Owner and Client" sections in the report.

### Sprint 5 - Sprint 8

The screenshot shows the continuation of the Trello board for "Bachelorprosjekt Atea". It features four columns for Sprints 5 through 8, and a fifth column for "Add another list".

- Sprint 5 / 20. - 31.mars**: Contains six cards. Tasks include getting a "bestillingsoversikt" for regular users, admin approval of functionality, admin review of responses, user responses with status, admin data retrieval, and another "bestillingsoversikt" for admin.
- Sprint 6 / 10.april-24.april**: Contains five cards. Tasks include finding chapter 5, setting tooltips and accessible labels on ALT, sorting admin app by status, and fixing required fields in the shared schema.
- Sprint 7 / 27.april-5.mai**: Contains six cards. Tasks include reading chapter 4, defaulting button states, writing test results for chapter 7, checking contrast in PA, writing reflection for chapter 8, writing conclusion for chapter 10, and writing a team evaluation.
- Sprint 8 / 8.mai-16.mai**: Contains six cards. Tasks include creating a video for the project, fixing all footnotes, reading all comments, reading all chapters and writing corrections, creating a presentation, and adjusting ALT in Power Apps Admin and regular user views.

## Appendix 6 - Sprints

Here is a screenshot of the document, representing sprint 3. The full document can be accessed [here](#).

### Sprint 3

Dato: 20.Feb - 3.Mars

#### Sprint Planning

Tilstede: Hedvig, Ingebjørg, Eigill and Karoline

**Sprint goal:** Brukertestning på prototypen og gjennomføre intervjuer med brukerne av systemet + Starte i Power Apps

**Sprint tasks:**

- Brukertestning på prototypen
- Gjennomføre intervjuer med brukerne
- Starte i Power Apps
- Sette opp en tabell i Dataverse
- Planlegge styringsgruppemøte

#### Sprint Review (Styringsgruppemøte 1)

Hva som ble presentert

Møtet ble innledet ved å informere om at gruppen har laget en tabell i Dataverse. Denne tabellen fungerer som datakilden til appen. Videre presenterte gruppen hva som har blitt utviklet til nå i Power Apps. Etter gruppen hadde presentert appen, ble det spurt om tilbakemeldinger til det som var utviklet så langt. Gruppen hadde også spørsmål til Ingeniørvesenet relatert til kommunikasjon fremover, samt praktiske detaljer i forhold til appen. Det ble også bestemt at Admin-grensesnittet skal lages som en egen app.

Planen videre

Planen videre i neste sprint er hovedsakelig å videreutvikle det som er startet på i Power Apps. Målet er å opprette alle nødvendige sider for bruker, samt å komme godt i gang med admin-appen. Mandag 06.03 vil det bli gjennomført intervjuer og brukertestning, og denne vil påvirke veien videre. Dersom resultatene fra dette tilsier at det burde gjøres endringer i design eller logikk, vil dette også bli fokus fremover.

## Sprint Retrospective

### Reflections:

- Fikk ikke testet grunnet dårlig kommunikasjon med produkteier
- Tålmodighetsprøve å ikke kunne utvikle flere enn én person samtidig. Det føles ikke så effektivt, og de andre gruppe medlemmene blir fort passive.
- Vi har brukt Ingvild mer (blant annet booket rom på Atea-kontoret og jobbet der)
- Kommet frem til at vi skal splitte systemet inn i to applikasjoner, dette vil mest sannsynlig løse "dele"-problemet i forhold til utvikling.

### Adjustments for next sprint:

- Være flinke til å bytte på hvem som utvikler i Power Apps
- De som "ser på" kan bli flinkere til å komme med løsninger, inkludere seg selv, men samtidig ikke være for "ivrige" på den som utvikler
- Fortsette å være flinke til å kommunisere med Ingvild

## Appendix 7 - Daily Scrum

Here is a screenshot of the document, representing documentation from some Daily Scrum meetings. The full document can be accessed [here](#).

### 9.mars

- Power Apps videre utvikling
- Booke grupperom for neste torsdag
- Opprette app nr.2 - admin grensesnitt
- Pop-ups

### 13.mars

- Lage transparent bakgrunn for popup
- Fikset alle knapper som kan fikses
- Lage popup for administrator-sidene
- Lage siden for mine forespørsler
- Sende mail til IV om at Sprint Review er avlyst/droppes
- Booke rom for neste mandag
- Finne ut av hva vi trenger hjelp til i PA av Ingvild

### 14.mars

- Få hjelp av Ingvild til å hente inn data til "mine forespørsler"
- Fikse navn-kolonnen?
- Headeren er ikke fleksibel
- Architectural design rapporten
- Back() funksjonen på bestillingsoversikt - hvordan fungerer dette med en komponent?
  - Kommer an på hvordan vi legger det opp
  - Enten sette noen variabler som sier noe om hvilke verdier som er på siden.
  - Bruk collection / variabler
- Spørsmål til Ingvild: Hvorfor er knappene skjeve når vi har like mange beholdere på hver side?
  - Fikset ved hjelp av Ingvild
- Bestillingsoversikt - Forskjellige felter for hva man har bestilt - hvordan filtrer ut det i bestillingsoversikten - sånn at man ikke sender med mange tomme felter
  - Kan bruke if (ikke overdriv bruken av det), eller switch (hvis du har fire valg, så sjekker den alle)
  - kan bruke visible (hvis du har valg dette, og dette, så skal dette vises) - husk fleksibel høyde

### Intervjuguide - semistrukturert intervju

1. Hvordan vil du vurdere din digitale forståelse på en skala fra 1-5?
2. Hvor ofte leier du maskiner/kjøretøy?
3. Hvordan leier du en maskin per dags dato?
4. Hvordan synes du dagens løsning fungerer?
5. Hvor tidkrevende er dagens løsning? (cirka hvor lang tid tar det fra du viser interesse til du får bekreftelse)
6. Hva fungerer godt med dagens løsning?
7. Hva fungerer dårlig med dagens løsning?
8. Hva er et typisk problem du møter på når du skal leie maskin(er) i dag?
9. Hvordan ville du vurdert dagens system på en skala fra 1-10?
10. Hva tankene dine rundt at systemet kan byttes ut til en app?
11. Hvordan ser du for deg at denne appen kan gjøre ting enklere for deg?
12. Hva er de viktigste funksjonene for deg i en slik app?
13. Hva ser du for deg kan bli den største utfordringen med et nytt system?
14. Andre kommentarer?

## Appendix 9 - User stories

### Reading instructions:

The user stories is prioritized from 1.1 → 1.7 etc., where 1.1 is the most important and 1.7 is the least important within each category (must have, should have etc.).

1 = must have

2 = should have

3 = could have

### User story 1.1

**Demand:** As a **user**, I want to be able to send a rental request for a vehicle, through a computer application, so I can increase my efficiency.

**Activity:** Send a rental request for a vehicle through a form

**MoSCoW:** Must have

**Argument:** This user story is about the renting process for employees. The customer wants to make this process more fluent/effective than it is today. This will be the main functionality of the app, and therefore it has been prioritized as “must have”.

**Criteria:** After a user has logged in to the app (through Microsoft Teams/Microsoft user), they will have the option to rent a vehicle. Further, the user will get an overview of the categorized vehicles. Then, the user chooses the desired category and they will specify certain criterias for their rental, such as renting period and specific criterias for the vehicles in question. Further, the user will see a summary of their order, and can choose to confirm this and send the request, or go back one step to edit the order. When the user clicks “Send forespørsel”, they will get a pop-up that asks “Er du sikker?”, or "Avbryt". If the user is sure they will get confirmation that the request has been sent. If they are unsure they will return to the summary.

### Test-scenario:

- Log in
- Choose “Innleie av maskiner”
- Choose the desired type of vehicle
- Choose specific criterias for the order in question
- Send the request
- (User gets asked if they are sure)
- Choose “Send forespørsel”
- (If the user is sure - gets a pop-up confirming a successful send-in)
- Choose “Ok”
- (User gets directed to "Mine forespørsler")

## User story 1.2

**Demand:** As an **administrator**, I want to be able to receive and approve rental requests from users, so I can pass on the order request to the supplier.

**Activity:** Receive requests and pass them on to the relevant suppliers.

**MoSCoW:** Must have

**Argument:** This user story is about after getting digital requests - automatically after a user has placed an order. The current system is adequate, but it is outdated and there is room for improvement - especially in regards to efficiency. In this way, the administrator will receive incoming orders more fluently and will easily be able to approve or decline them.

**Criteria:** After the administrator has logged in, he can choose "Avventede forespørsler". The rental requests that have been made by the users, are displayed by a list and have a "Vis mer"-button that can be pressed to see the request details. On this page the administrator can approve or decline the request. Further, regardless of the administrator approving og declining the request, it will be shown a pop-up that asks if the administrator is sure, and then the administrator is sent to "Avventende forespørsler". There, the administrator can see the processed request.

**Test-scenario:**

- Log in
- Choose "Avventende leieforspørsler"
- Choose a request from the list
- Click on the "Vis mer"
- Approve the request
- (Admin gets asked if he is sure in a pup-up)
- Choose "Godkjenn forespørsel"
- (Admin is sent to "Avventende forespørsler")
- The administrator get in touch with the supplier

## Prioriteringsliste med MoSCoW:

*Must have*

User story	Criteria	Argument
<p><b>1.3</b> As a <b>user</b>, I want to be able to specify various criteria for my request, so that it can fit my needs.</p>	<p>The user will get a form to fill out, where they will specify the rental period, whether they need a worker and more specific criterias to the vehicle in question.</p>	<p>It is vital that the user can specify their needs in their rental request for the vehicle in question, so that the administrator is able to reach out to relevant suppliers to give them the most suitable vehicle. Also, for the administrator, this is key information for the rental process.</p>
<p><b>1.4</b> As a <b>user</b>, I want to be able to go back and change my criteria if I notice something is wrong on the "Bestillingsoversikt" page, so that the administrator will get a correct request.</p>	<p>If the users notice something is wrong in their request, the user can click "Nei, endre skjema". The user will be sent back to the previous page (the form), and can edit their criterias.</p>	<p>This makes the user double check their requests, and should lead to less user errors.</p>
<p><b>1.5</b> As an <b>administrator</b>, I want to have the opportunity to decline a rental request, so that I can let the user know that the vehicle in question cannot be obtained.</p>	<p>When the administrator opens a rental request, he can decline the request by clicking "Avslå forespørsel". The user will be notified with the response automatically through a Power Automate Flow.</p>	<p>In this way, the administrator will be able to give the user notice that the vehicle in question cannot be obtained in an efficient manner.</p>



<p><b>1.6</b> As a <b>user</b>, I want a system that is user-friendly, so that processes within the app are efficient.</p>	<p>For the system to be user-friendly, design principles will be used. More precisely, to create a universal design Benyon's 12 design principles will be followed. The system will only contain the necessary functions, to minimize user errors.</p>	<p>An attractive design will simplify the maneuvering throughout the system. Since the system has visual progress steps in the renting process, it fulfills the efficient and the user-friendly goal.</p> <p>We have chosen to place this on must have, because it is very important that as many people as possible, regardless of digital ability, are able to use the app.</p>
<p><b>1.7</b> As a <b>user</b>, I want the system to give me confirmation that my rental request has been sent, so that I'm sure that I have successfully sent my order.</p>	<p>When the user has specified their vehicle order, the system will show a summary of their order on a site called "Bestillingsoversikt". Here the user can choose to actually send their rental request or go back a step and edit if they see incorrect specifications.</p> <p>When the user clicks "Send forespørsel", they will get a pop-up that says "Er du sikker på at du vil sende forespørselen din?". Then the user could go back if they are not sure, or go ahead and click "Send forespørsel". Lastly, the users get a confirmation pop-up and will be sent to "Mine forespørsler" showing the</p>	<p>The system needs to have this feature, so that the user is sure that the rental request actually is sent. The fact that the system asks if the user is sure about sending the request makes the system reliable, and prevents user errors.</p>

	users current bookings.	
--	-------------------------	--

*Should have*

User story	Criteria	Argument
<b>2.1</b> As an <b>administrator</b> , I would like to have a list of contact details, so that I'm able to contact the relevant external companies.	There will be a button to click on the front page named "Eksterne aktører" which leads to a page containing the list of contact details.	In order for the administrator to contact the vehicle supplier in an easy way and have things at the same place, it would be efficient to include the list of contacts within the application.
<b>2.2</b> As a <b>user</b> , I want a function that makes it possible to cancel a request, so that I give a notice that I won't need the vehicle after all.	The user goes to "Mine forespørsler" and is able to cancel the rental request by clicking on "Kanseller" (with a cancel sign by it).	The user should be able to cancel a request if they don't need a vehicle anymore. This will reduce workload for the administrator and prevent misconceptions.
<b>2.3</b> As a <b>user</b> , I want to get a notification when the administrator has processed my rental request, so that I can see the answer to the request immediately.	This will be solved by creating a Power Automate Flow to generate a notification on email to the user when the administrator has processed the renting request.	The user should be informed about the outcome of the request. This will lead to a more efficient and informative system.
<b>2.4</b> As a <b>user</b> , I want to see the order status of my rental requests on "Mine forespørsler", so that I can see if my rental request has been approved, declined or delivered.	The user clicks on "Mine forespørsler" and can see the status of the rental request on the order line. A Power Automate Flow will change the status as the administrator processes the request.	A system that gives the user a clear understanding of what the status is on the request, makes the system more valuable.

Could have

User story	Criteria	Argument
<p><b>3.1</b> As an <b>administrator</b>, I want to be able to get an overview of the active rentals, so that I can see when the clients' contracts expire.</p>	<p>The administrator will be able to click "Avventende forespørsler" and will then get an overview over current rentals. The current rentals will arrive here (by a Power Automate Flow) after a request has been approved by the administrator.</p>	<p>Since the system is dynamic, it will be necessary to keep control of the current rentals. Here the administrator can see when the contract (rental period) expires. This will lead to a more efficient overview of the contracts between users and administrator.</p>
<p><b>3.2</b> As a <b>user</b>, I want to receive a notification when the contract is about to expire, so I get a reminder to deliver the vehicle on time.</p>	<p>The notification will be sent on email and will be added automatically according to the delivery date through Power Automate Flow.</p>	<p>On this occasion, employees will get a reminder that it is time to deliver the vehicle. In this way, duties and other tasks can be made more effective and time saving.</p>


*Wont have - Won't-haves: features you'd like to implement, but can't for some reason.*

User story	Criteria	Argument
<p><b>4.1</b> As a <b>user</b>, I want the system to give me the opportunity to register a damage on the vehicles, so the administrator can pass on this matter to the vehicle suppliers.</p>	<p>If damage occurs, then a report should be written. This will be a button on the front page in the header that will lead to a damage report form. In this form the user can choose the order/rental in question and fill out the form. By confirming the damage report, an email will be sent to the administrator, by using a Power Automate Flow.</p>	<p>In order for Ingeniørvesenet to have an efficient rental system, the user should be able to report any damage or issues that may have occurred in the rental period. In this way, there will be a chance for service and maintenance.</p>
<p><b>4.2</b> As an <b>administrator</b>, I want to get statistics on what vehicles that get rented the most, so that I can acquire a greater</p>	<p>There will be a button on the front page named "Leie statistikk". This will lead to a page where it shows the amount of rentals by</p>	<p>With an overview like this, the administrator will get a summary of which vehicle(s) that is most popular. Thus, the administrator can</p>

<p>understanding of the use of vehicles.</p>	<p>category for a selected period.</p>	<p>consider if it should acquire more deals with external suppliers.</p> <p>Vehicles that get more rented than others, will also need more maintenance from the suppliers.</p>
--	--	--

## Appendix 10 - Persona (the administrator)

### Fredrik Guttormsen



AGE	56
EDUCATION	Masters in construction engineering
STATUS	Married
OCCUPATION	Ingeniørvesenet
LOCATION	Kristiansand
TECH LITERATE	Medium +

“ Effective system administration is about balancing the needs of the system with the needs of its users.

#### Personality

Extrovert Charismatic

#### Bio

He lives in Vennesla, and has been married for 31 years. On his freetime he likes to play paddle tennis and learn new things online. Fredrik has functioned as the administrator of Ingeniørvesenets rental solution for the last 7 years.

#### Core needs

- Needs an overview of which projects the different construction vehicles is rented to.
- Need to be able to process rental requests efficiently.
- Need an overview of unprocessed rental requests.

#### Frustrations

- Frustrated with constant calls from colleagues that needs to rent vehicles.
- Frustrated with constantly forgetting which requests he has processed and not.
- Frustrated with not having an "all-in-one" platform in regards to rentals.

## Appendix 11 - MoSCoW

Regular user	Administrative user
<b>(1) Must have</b>	<b>(1) Must have</b>
<ol style="list-style-type: none"> <li>1. The possibility to send a rental request</li> <li>2. See an overview of all the vehicle categories</li> <li>3. Choose dates for rental period</li> <li>4. Specify the rental request</li> <li>5. Recieve a confirmation of the sent request</li> <li>6. Possibility to change request before sending</li> <li>7. User friendly design</li> </ol>	<ol style="list-style-type: none"> <li>1. Have his own GUI</li> <li>2. Approve rental request</li> <li>3. Decline rental requests</li> </ol>
<b>(2) Should have</b>	<b>(2) Should have</b>
<ol style="list-style-type: none"> <li>1. Possibility to cancel bookings</li> <li>2. Notification when rental request is processed</li> <li>3. Be able to see the status of the request</li> <li>4. Sort rental requests by status</li> </ol>	<ol style="list-style-type: none"> <li>1. Contact information for external companies</li> <li>2. See an overview of the equipment rented</li> <li>3. Sort rental requests by status</li> </ol>
<b>(3) Could have</b>	<b>(3) Could have</b>
<ol style="list-style-type: none"> <li>1. Notification when the delivery day is coming up</li> </ol>	<ol style="list-style-type: none"> <li>1. See when the contract has expired</li> </ol>
<b>(4) Won't have</b>	<b>(4) Won't have</b>
<ol style="list-style-type: none"> <li>1. Possibility to register damage</li> </ol>	<ol style="list-style-type: none"> <li>1. Overview and statistics of what vehicles gets rented the most</li> </ol>

## Appendix 12 - Interview results

Below is a screenshot from the results of interviewing one participant. The full document can be found [here](#).

### Deltaker A

**1. Hvordan vil du vurdere din digitale forståelse på en skala fra 1-5?**

5, sammenlignet med dere så er det 2.

**2. Hvor ofte leier du maskiner/kjøretøy?**

2-3 ganger i året.

**3. Hvordan leier du en maskin per dags dato?**

Ring på telefon å booke, Andreas sjekker om det er ledig.

**4. Hvordan synes du dagens løsning fungerer?**

Kjempedårlig.

**5. Hvor tidkrevende er dagens løsning? (cirka hvor lang tid tar det fra du viser interesse til du får bekreftelse)**

Spørs på hvor opptatt Andreas er, alt fra 10 min, til 1 time, til en dag.

**6. Hva fungerer godt med dagens løsning?**

Behovet, da får han [deltaker A] beskjed om hva han trenger om han er usikker.

**7. Hva fungerer dårlig med dagens løsning?**

Tidkrevende, må ringe 1-3 ganger til Andreas dersom han er opptatt.

**8. Hva er et typisk problem du møter på når du skal leie maskin(er) i dag?**

Jeg må ringe flere ganger til Andreas.

**9. Hvordan ville du vurdert dagens system på en skala fra 1-10?**

6.

**10. Hva tankene dine rundt at systemet kan byttes ut til en app?**

Jeg synes det er veldig positivt, vi trenger en bedre løsning som er digitalisert.

**11. Hvordan ser du for deg at denne appen kan gjøre ting enklere for deg?**

Jeg kommer til å spare tid og energi.

**12. Hva er de viktigste funksjonene for deg i en slik app?**

At den er lett, og ikke tungvint. Den skal være lett å forstå, lett å leie, lett forståelig.

**13. Hva ser du for deg kan bli den største utfordringen med et nytt system?**

Kommer an på oss [brukerne].

**14. Andre kommentarer?**

Nei

## Appendix 13 - User testing results

Below is a screenshot from the results from user testing one participant. The full document can be found [here](#).

### Deltaker A

#### Testscenario 1

- "Det står jo der" finner mine forespørsel fort
- Ser fra-til feltet på dato
- Ser registeret på hva som skal leies/lånes
- Ser det står hva som er godkjent/ikke
- Viser god forståelse når han navigerer seg/rundt på siden
- **Oppgave, gå til hjem:** tenker litt - kan gjøre hjem tegnet større/mer synlig - så ikke med en gang (foreslår å skrive "Home"? i tilknytning til Hjem-ikonet)

#### Testscenario 2

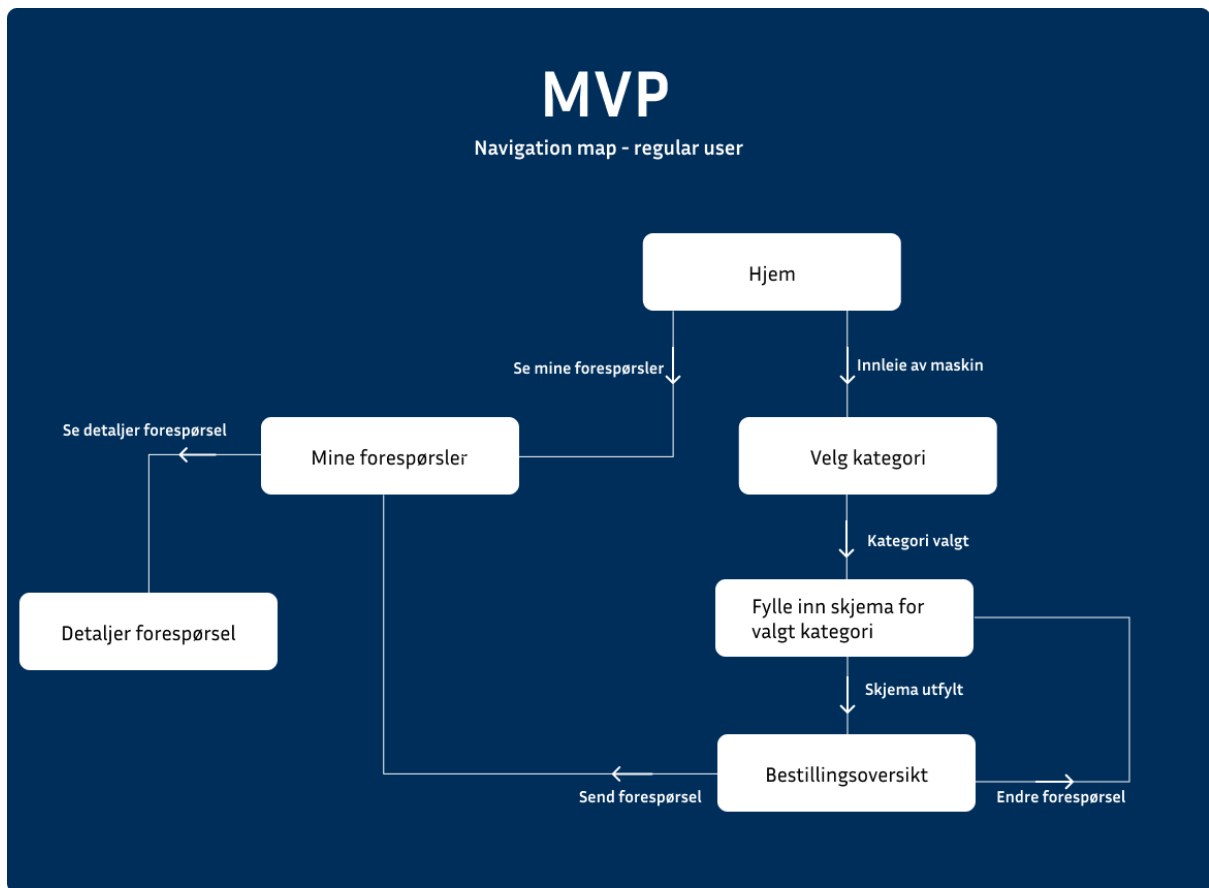
- Finner raskt "innleie", ser litt på rundt på Generell Info siden, ser feltene og skjønner at han må fylle inn feltene med nødvendig informasjon angående et prosjektet.
- Finner "neste-tegnet" raskt (for å navigere seg til neste side)
- Ser litt rundt på siden og finner riktig alternativ
- I skjema velger dato
- Navigerer seg raskt gjennom skjema med kriterier
- "Lett å forstå"
- Bestillingsside: Ser gjennom oversikten
- Tenker å sende forespørsel og navigerer seg raskt gjennom pop-upene

#### Kommentarer:

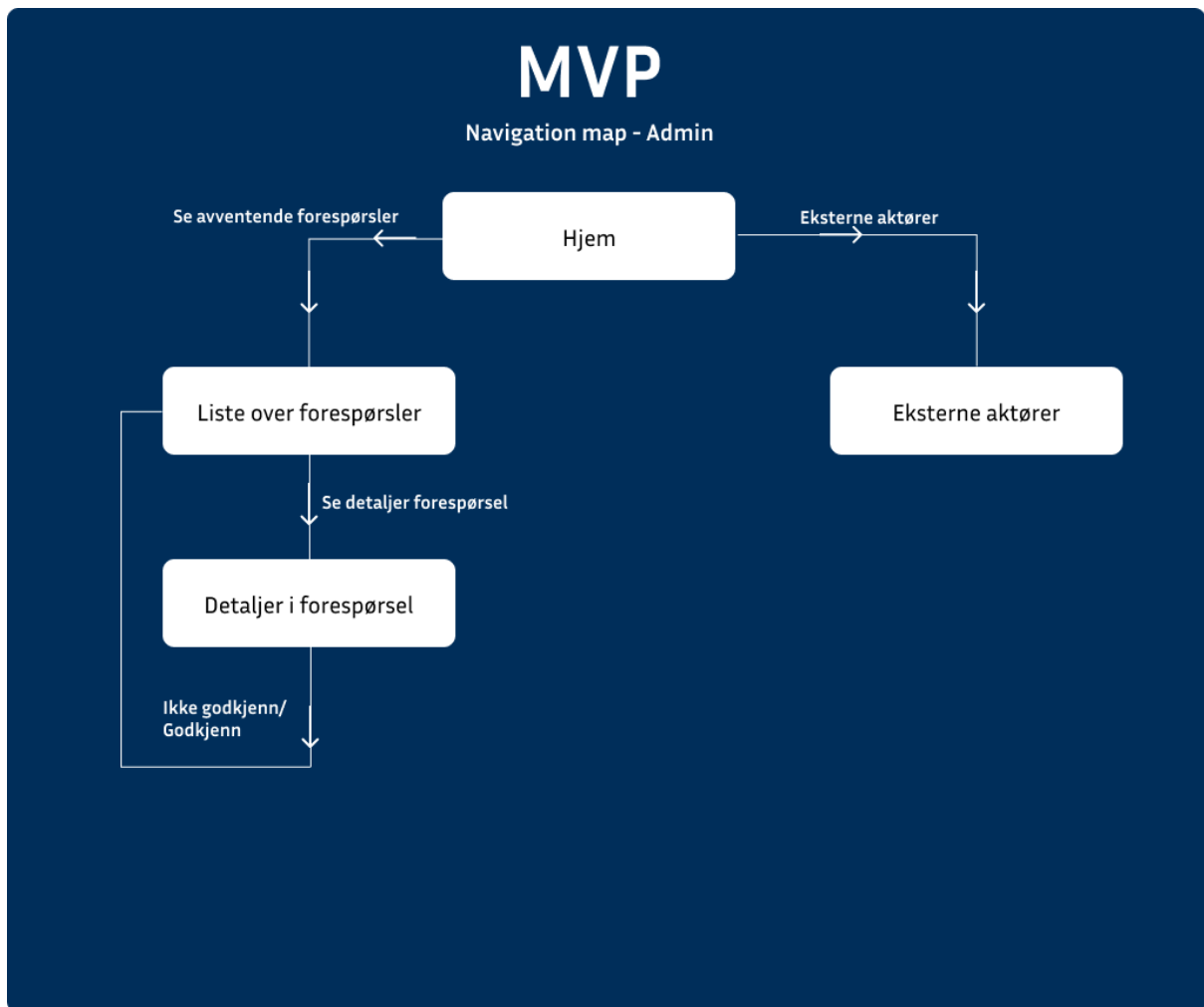
- Gjøre ting ekstra synlig (spesielt huset)
- HUSK: e-postvarsel på at en forespørsel er godkjent.
- Redd for at ting fortsatt kan bli halvveis uten notifikasjoner i appen



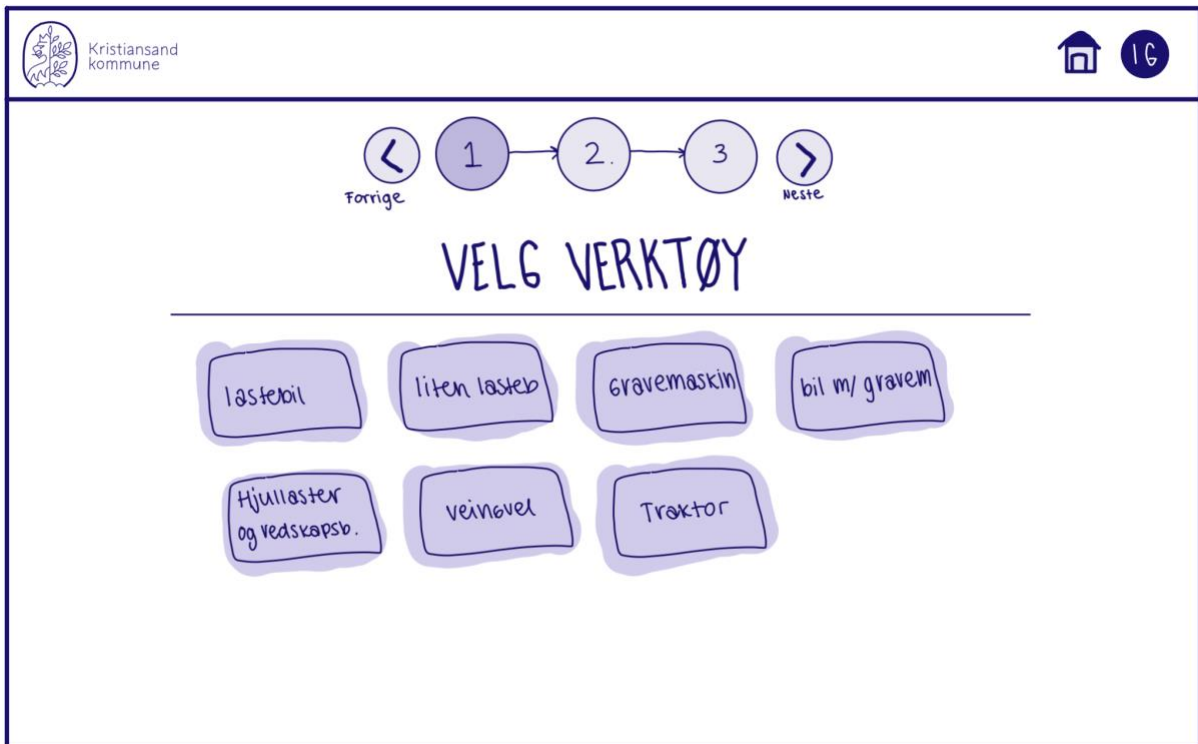
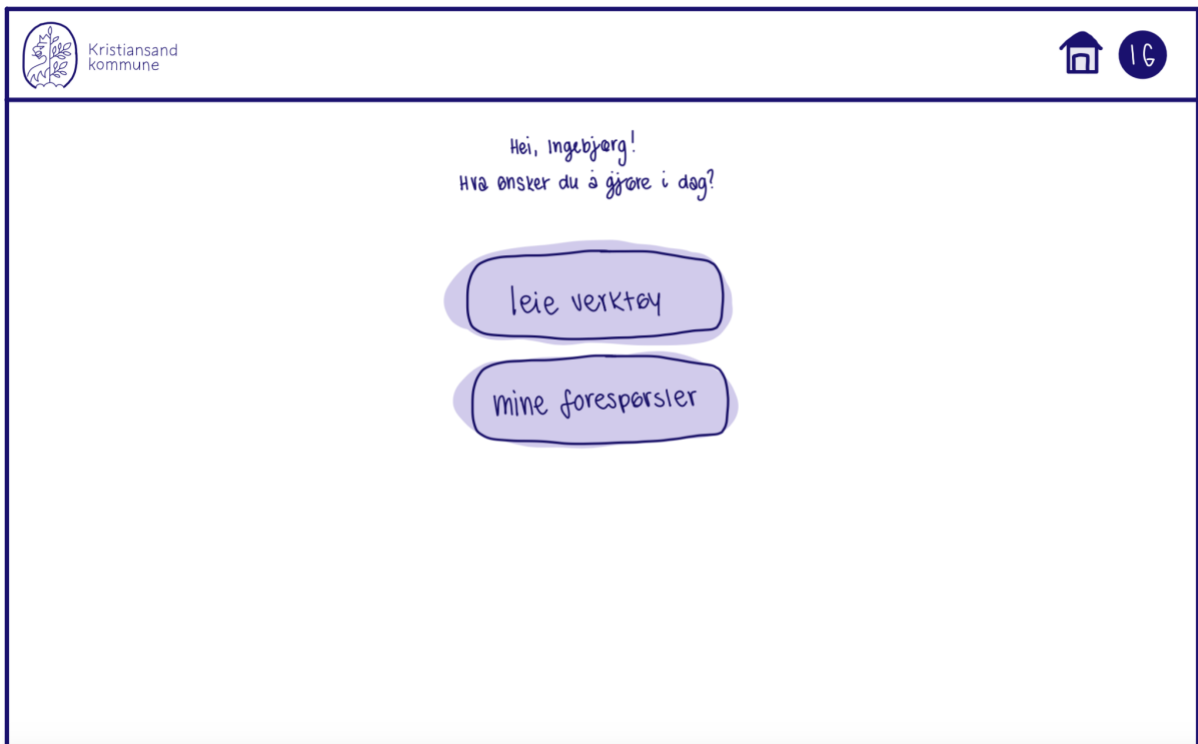
## Appendix 14 - Navigation map for the regular users

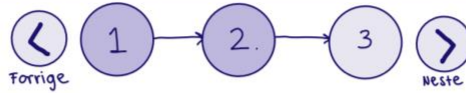


## Appendix 15 - Navigation map for administrative user



## Appendix 16 - Sketches for the regular users





## FYLL INN SKJEMA FOR FORESPØRSEL

Velg start- og sluttdato:  til:

Jeg ønsker med mann:  Ja  Nei

antall akslinger:  ▼

Jeg ønsker henger:  Ja  Nei

Med krok:  Ja  Nei

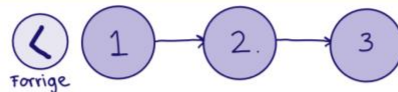
Med krøn:  Ja  Nei

Jeg ønsker tippbil:  Ja  Nei

Jeg ønsker tippsemi:  Ja  Nei

annet:

Fritekst



## BESTILLINGSOVERSIKT

verktøy:	Grøvemaskin
utleiedato:	01.01.23 til 01.04.23
Med mann:	Ja
antall akslinger:	3
Med henger:	Ja
Med krok:	Ja
Med krøn:	Nei
Tippbil:	Nei
Tippsemi:	Ja
annet:	-

Ønsker du å sende forespørselen?

[nei, endre skjema](#)

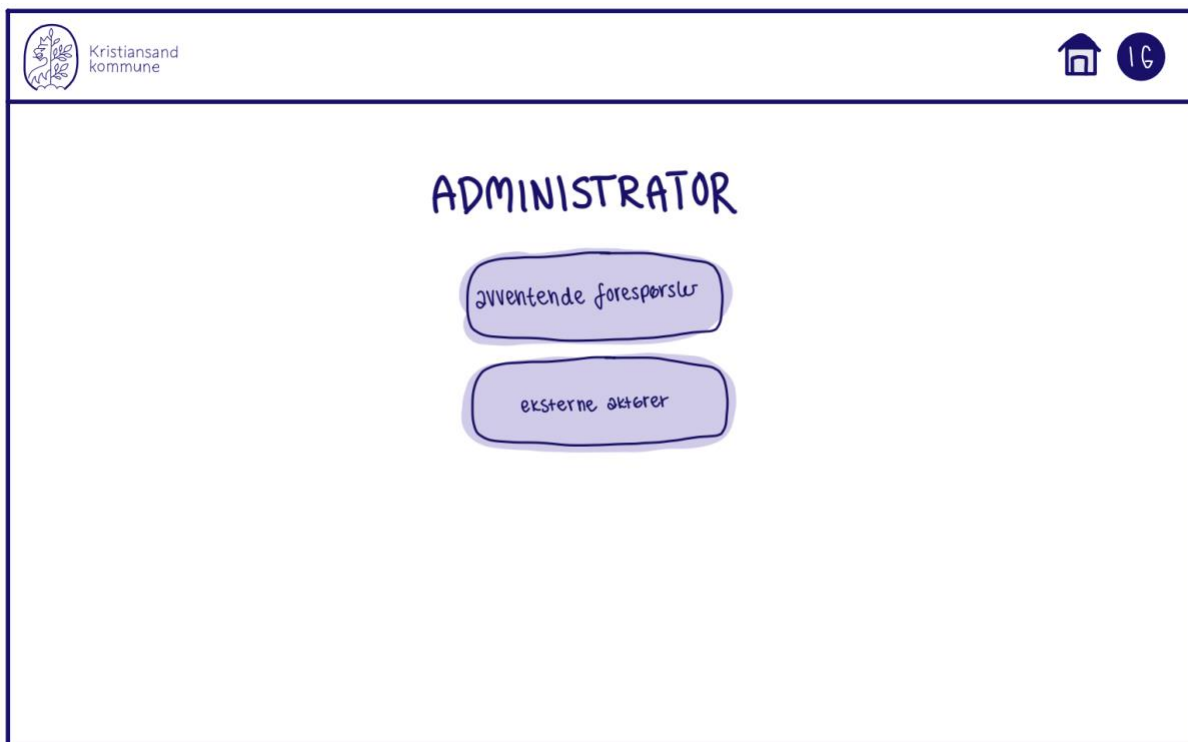
[send forespørsel](#)



## MINE FORESPØRSLER

Maskin	fra	til	status	vis mer
Gravemaskin	01.01.23	01.04.23	under behandling	✓
løstebil	01.01.23	01.04.23	under behandling	✓
veihovel	01.01.23	01.04.23	under behandling	✓
liten løstebil	01.01.23	01.04.23	under behandling	✓
bil m gravemaskin	01.01.23	01.04.23	avslått	✓
traktor	01.01.23	01.04.23	godkjent	✓
hulløster	01.01.23	01.04.23	godkjent	✓
gravemaskin	01.01.23	01.04.23	godkjent	✓
løstebil	01.01.23	01.04.23	avslått	✓
veihovel	01.01.23	01.04.23	godkjent	✓
traktor	01.01.23	01.04.23	godkjent	✓
bil m gravemaskin	01.01.23	01.04.23	avslått	✓
hulløster	01.01.23	01.04.23	godkjent	✓
veihovel	01.01.23	01.04.23	godkjent	✓
liten løstebil	01.01.23	01.04.23	godkjent	✓

## Appendix 17 - Sketches for the administrative user



Kristiansand kommune

AVVENTENDE FORESPØRSLER

Maskin	fra	til	status	åpne
Gravemaskin	01.01.23	01.04.23	under behandling	
lastebil	01.01.23	01.04.23	under behandling	
veihovel	01.01.23	01.04.23	under behandling	
liten lastebil	01.01.23	01.04.23	under behandling	
bil m gravemaskin	01.01.23	01.04.23	avslått	
traktor	01.01.23	01.04.23	godkjent	
hulløster	01.01.23	01.04.23	godkjent	
gravemaskin	01.01.23	01.04.23	godkjent	
lastebil	01.01.23	01.04.23	avslått	
veihovel	01.01.23	01.04.23	godkjent	
traktor	01.01.23	01.04.23	godkjent	
bil m gravemaskin	01.01.23	01.04.23	avslått	
hulløster	01.01.23	01.04.23	godkjent	
veihovel	01.01.23	01.04.23	godkjent	
liten lastebil	01.01.23	01.04.23	godkjent	

The sketch shows a table titled 'AVVENTENDE FORESPØRSLER'. The table has five columns: 'Maskin', 'fra', 'til', 'status', and ' åpne'. The data rows show various machine types and their corresponding dates and statuses. The 'status' column contains values like 'under behandling', 'avslått', and 'godkjent'. The ' åpne' column is currently empty.



## DETALJER OM FORESPØRSEL

Utlån startdato: 01.01.23  
Utlån sluttdato: 01.03.23  
Maskin: Lastebil  
Hensikt: massetransport  
Med mann: Ja  
øntall akslinger: 3  
med krok: Ja  
med trø: Nei  
tippbøl: Ja  
tippsemi: Nei  
kommentar: \_\_\_\_\_

avslø foresp.

Godkjenn f.



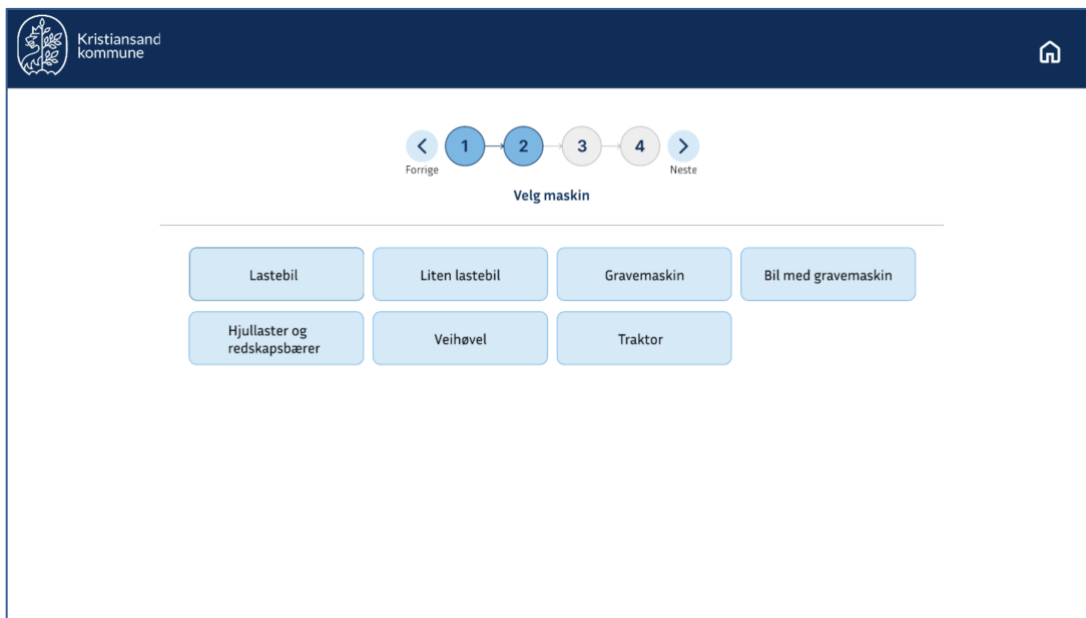
## MINE FORESPØRSLER

Bedrift	Mailadresse	Telefonnummer	Annet
Fietoft AS	mailadresse@mail.com	949 77 019	eventuell kommentar

## Appendix 18 – Prototype regular user

The full prototype for the regular user application can be viewed [here](#). To access the prototype, it is necessary to create a user in Figma and request access. Four screenshots from the prototype can be viewed below.

### Screenshot from the “Velg kategori”- page:



Kristiansand kommune

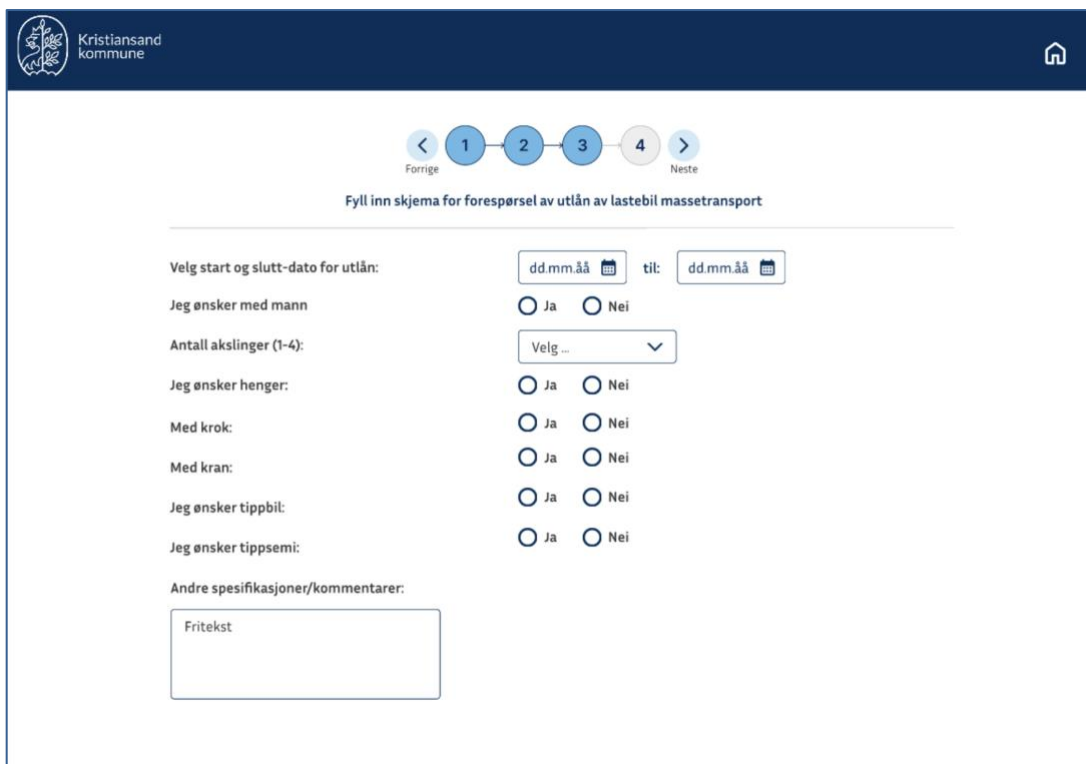
Velg maskin

Forrige 1 2 3 4 Neste

Lastebil Liten lastebil Gravemaskin Bil med gravemaskin

Hjullaster og redskapsbærer Veihevel Traktor

### Screenshot from the “Fyll ut skjema”- page:



Kristiansand kommune

Fyll inn skjema for forespørsel av utlån av lastebil massetransport

Forrige 1 2 3 4 Neste

Velg start og slutt-dato for utlån: dd.mm.åå til: dd.mm.åå

Jeg ønsker med mann  Ja  Nei

Antall akslinger (1-4): Velg ...

Jeg ønsker henger:  Ja  Nei

Med krok:  Ja  Nei

Med kran:  Ja  Nei

Jeg ønsker tippbil:  Ja  Nei

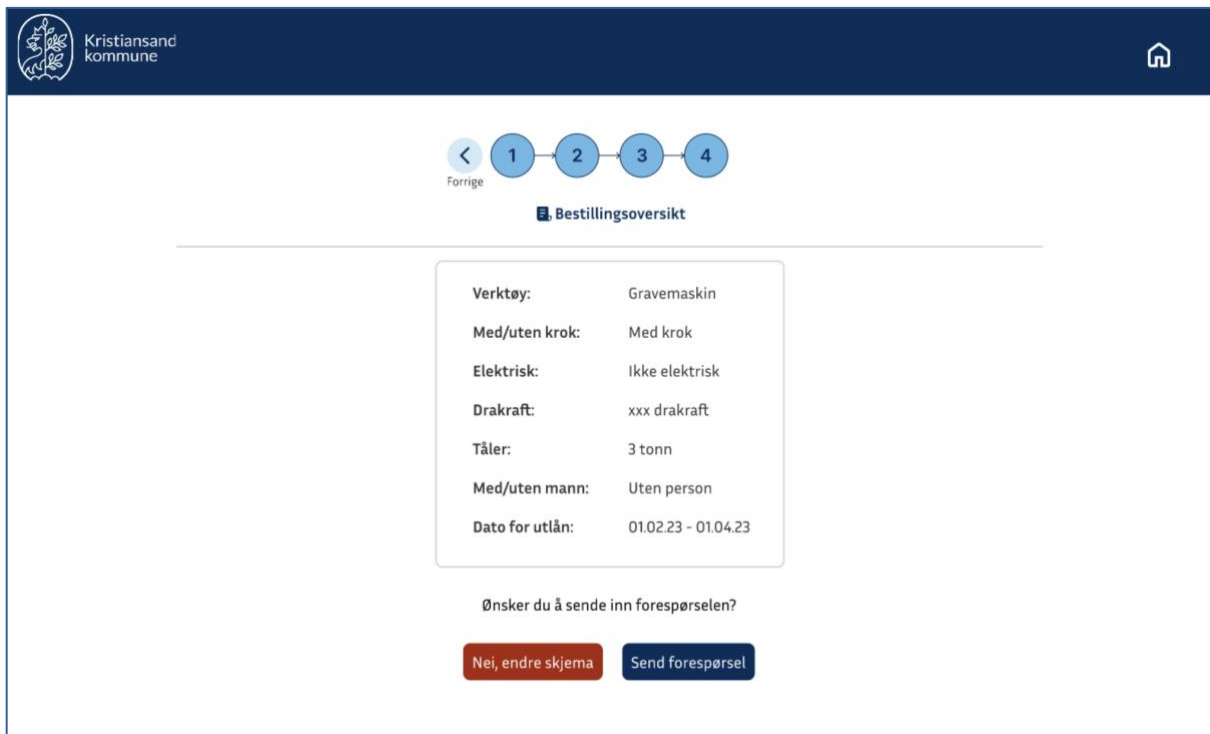
Jeg ønsker tippsemi:  Ja  Nei

Andre spesifikasjoner/kommentarer:

Fritekst



Screenshot from the "Bestillingsoversikt"- page:



Kristiansand kommune

Forrige

1 2 3 4

Bestillingsoversikt

Verktøy: Gravemaskin

Med/uten krok: Med krok

Elektrisk: Ikke elektrisk

Drakraft: xxx drakraft

Tåler: 3 tonn

Med/uten mann: Uten person

Dato for utlån: 01.02.23 - 01.04.23

Ønsker du å sende inn forespørselen?

Nei, endre skjema Send forespørsel

Screenshot from the "Mine forespørsler"- page:



Kristiansand kommune

Mine forespørsler:

Maskin	Fra	Til	Status	Vis mer
Gravemaskin	01.01.23	01.03.23	Godkjent	▼
Gravemaskin	01.01.23	01.03.23	Under behandling	▼
Gravemaskin	01.01.23	01.03.23	Godkjent	▼
Gravemaskin	01.01.23	01.03.23	Ikke godkjent	▼
Gravemaskin	01.01.23	01.03.23	Godkjent	▼
Gravemaskin	01.01.23	01.03.23	Under behandling	▼
Gravemaskin	01.01.23	01.03.23	Godkjent	▼
Gravemaskin	01.01.23	01.03.23	Ikke godkjent	▼
Gravemaskin	01.01.23	01.03.23	Godkjent	▼
Gravemaskin	01.01.23	01.03.23	Ikke godkjent	▼
Gravemaskin	01.01.23	01.03.23	Godkjent	▼

## Appendix 19 – Prototype administrator

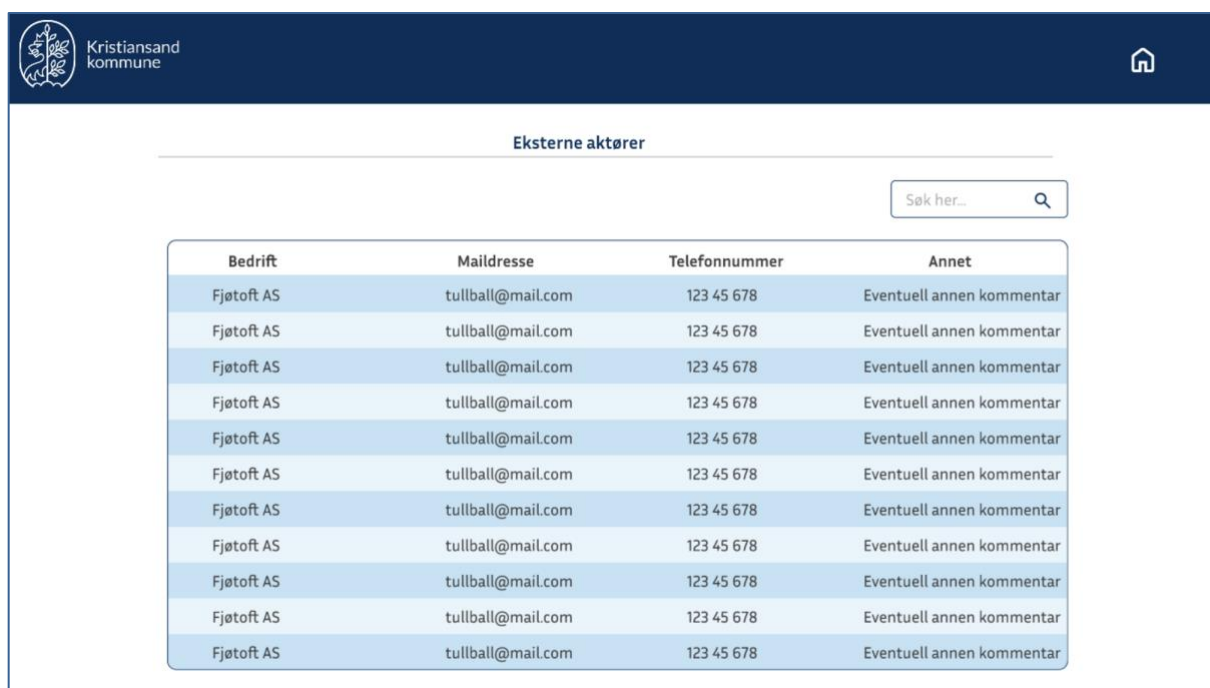
The full prototype for the administrator application can be viewed [here](#). To access the prototype, it is necessary to create a user in Figma and request access. Three screenshots from the prototype can be viewed below.

Screenshot from the “Avventende forespørsler”- page:




Maskin	Bruker	Fra	Til	Status	Åpne
Gravemaskin		01.01.23	01.03.23	Godkjent	☑
Lastebil		01.12.22	01.01.23	Under behandling	☑
Truck		01.11.22	01.12.22	Godkjent	☑
Gravemaskin		01.10.22	01.11.22	Ikke godkjent	☑
Veihøvel		01.09.22	01.10.22	Godkjent	☑
Liten lastebil		01.08.22	01.09.22	Under behandling	☑
Hjullaster		02.06.22	20.06.22	Godkjent	☑
Traktor		17.05.22	29.05.22	Ikke godkjent	☑
Liten lastebil		01.04.22	20.04.22	Godkjent	☑
Hjullaster		09.03.22	19.03.22	Ikke godkjent	☑
Veihøvel		08.01.22	20.01.22	Godkjent	☑

Screenshot from the “Eksterne aktører”- page:



Bedrift	Mailadresse	Telefonnummer	Annet
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar
Fjøtoft AS	tullball@mail.com	123 45 678	Eventuell annen kommentar

Screenshot from the "Detaljer om forespørsel"- page:

Kristiansand kommune 

### Detaljer om forespørsel

Utlån startdato:	01.01.23
Utlån sluttdato:	01.03.23
Maskin:	Lastebil
Hensikt:	Massetransport
Med mann:	Ja
Antall akslinger:	3
Med krok:	Ja
Med kran	Nei
Tippbil:	Ja
Tippsemi:	Nei
Kommentar:	<div style="border: 1px solid black; padding: 5px;">Bla bla bla her kan det stå en kommentar</div>

Kommentar tilbake til den som forespurte maskinen ang hvilken maskin den har "fått" etc.

Avslå forespørselGodkjenn forespørsel

## Appendix 20 - Team evaluation

Throughout the project, the team has worked together efficiently and effectively. Each team member brought unique perspectives and skills to the project, allowing the team to approach problems from different angles and work towards creative solutions. However, the project had its challenges. One obstacle was the hard coding of some pages in the app, which later required changes to be made and the app to transition from a more static to a dynamic system. Additionally, the team encountered issues with Power Apps, which only allowed one person to develop at a time, leading us to adopt group programming practices. Despite these challenges, the team overcame them and delivered a high-quality solution. The project has provided a great learning opportunity, allowing the team to gain experience with new technologies and develop skills that will be valuable in future projects.

A more in-depth delegation of the work in the project can be found in Table 1.