CHALMERS
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# Designing a Mobile User Interface for Tree Professionals

## Identifying User Requirements of Arborists and Loggers for a Fleet Management System with a User-Centered Approach

Master's thesis in Computer Science and Engineering

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Gothenburg, Sweden 2025

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Cover: Image portraying the prototype of mobile user interface.

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# Abstract

Conducted in collaboration with Husqvarna Group, this study explores the specific user requirements of arborists and loggers in the context of mobile fleet management, aiming to design a user-centered interface that enhances their daily workflows. Currently, Husqvarna Fleet Services offers limited value to tree professionals, as its user interface and features are not sufficiently tailored to the unique needs of arborists and loggers.

Using the Double Diamond design process, the study employed qualitative methods including interviews and observations to identify user needs and translate them into clear user requirements. The defined user requirements covered areas such as machine data, battery management, GPS tracking, service and maintenance, and theft prevention. An ideation phase was initialized, including brainwriting and Crazy 8's, creating the foundation for the prototyping. The prototype was evaluated through user testing with both end-users and product specialists, indicating high perceived usability.

The prototype demonstrated high usability and through user tests key features were evaluated. Features adding the most value, which can increase the adoption of a mobile user interface for arborists and loggers, were real-time equipment tracking, reminders when forgetting or losing equipment, theft prevention, battery labeling, battery status and identification, and purchase of spare parts, supporting a more efficient and user-centered mobile user interface for tree professionals. Suggested future work includes broader end-user testing, investigating potential position tracking systems, and the process of purchasing spare parts, among others.

Keywords: Interaction design, UI design, UX design, user-centered design, design process, prototyping, fleet management system, arborist, logger, master's thesis.

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Adam Blomgren & Amanda Nyman, Gothenburg, 2025-06-15

# List of Acronyms

| | |
|---|---|
| **AR** | Augmented Reality |
| **DD** | The Double Diamond Design Process |
| **GDPR** | General Data Protection Regulation |
| **GIS** | Geographic Information System |
| **GUI** | Graphical User Interface |
| **HCD** | Human Centered Design |
| **HCI** | Human Computer Interaction |
| **IA** | Information Architecture |
| **LiDAR** | Light Detection and Ranging |
| **NFC** | Near Field Communication |
| **RtD** | Research through Design |
| **SEQ** | Single Ease Question |
| **SUS** | System Usability Scale |
| **UI** | User Interface |
| **UX** | User Experience |
| **WCAG** | Web Content Accessibility Guidelines |
| **WHO** | World Health Organization |

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# 1

# Introduction

Husqvarna Group serves as the second largest supplier of handheld products for tree professionals in the world, and the company strives to create valuable customer experiences [1]. Husqvarna Group has ambitions to increase their sales of electrified machines, as well as reach 6 million connected devices before 2026. The company also provides the digital fleet management system, Husqvarna Fleet Services™. The system is aimed at professional users of Husqvarna products, in which connected devices can be managed. However, the interface and its current features are more focused on larger companies. Therefore, tree professionals such as arborists and loggers have a limited reason to utilize Husqvarna Fleet Services™, as its current graphical user interface and its features are not fully optimized for their specific needs.

According to Husqvarna Group, there is a growing demand for an application more tailored to the needs of tree professionals [1]. This study in collaboration with Husqvarna aims to explore the specific user needs of arborists and loggers, in an app designed to suit their workday. These needs will serve as the foundation for a specification of requirements and a design proposal for the application's graphical user interface.

## 1.1 Research Question

Presented below is the research question (RQ) that will guide the study:

**RQ: What are the specific user requirements of arborists and loggers in a mobile user interface?**

Supported by the following sub-question (SQ):

SQ: Which valuable features can increase the adoption of a mobile user interface for arborists and loggers?

## 1.2 Stakeholders

In the following section, the primary stakeholders for the project are presented, consisting of the university carrying out the study, the company requesting the study, and the target group.

### 1.2.1 Chalmers University of Technology

Chalmers University of Technology, located in Gothenburg, Sweden, is the university where the thesis was written, assessed and published on. The university provided the supervisor, Thommy Eriksson, a senior lecturer in the field of interaction design among others. Chalmers also provided the examiner Staffan Björk, a professor in the field of interaction design. The project was carried out on the Department of Computer Science and Engineering (CSE) as the final course in the master's programme Interaction Design and Technologies. Courses from the programme such Interaction design methodology (TDA498) Prototyping in interaction design (CIU176), Graphical interfaces (DAT595), Information visualization (CIU187) and Open project in interaction design (CIU235) were especially relevant for the project.

### 1.2.2 Husqvarna Group

Husqvarna Group is a Swedish company founded in 1689 [2]. The company is known for its outdoor products such as robotic lawnmowers, chainsaws, and brush cutters. Husqvarna offers a wide range of products to a variety of customers and users, from individual homeowners who use an automower and a brush cutter for their garden, to large corporations with multiple employees managing a complete fleet of Husqvarna products. The thesis was written in collaboration with the department *Lead Engineers, Handheld R&D* and will be aimed towards tree professionals, primary using handheld tools such as chainsaws, pole saws and brush cutters. The value of Husqvarna Fleet Services™ for tree professionals remains somewhat unclear, as the service is primarily focused on customers using robotic lawnmowers and landscapers. Therefore, this study is of interest to Husqvarna Group in order to get an understanding of what could enhance the user value for tree professionals.

### 1.2.3 Target group

The study will be aimed towards tree professionals, including arborists and loggers. By identifying their user needs and translating them into concepts for the Husqvarna Fleet Services mobile application, the goal is to enhance the value of the service for them and potentially simplify their workdays. A deeper description of the target group is provided in 2.1. Additionally, the concept also brings interest for other roles within the organizations of tree professionals, such as managers and team leaders.

## 1.3 Demarcations

This project is limited to identifying user requirements and developing an interactive prototype of a mobile user interface, excluding specific user needs and development for tablet or desktop interfaces. This limitation is primarily due to the project's scope, considering time constraints and the thesis size. The study will not specifically target the current roles in the service, such as managers, technicians and operators, primary since it is not currently adapted to companies in arboriculture and logging, in which the organizational structure differs. To exemplify, it is not uncommon that arborists run a one-person business, making the roles unnecessary. The study will not address how the technical implementation of any potential solution would be carried out.

## 1.4 Ethical considerations

The project will involve conducting interviews and handling sensitive data. This will be done according to the General Data Protection Regulation (GDPR), which is a privacy and security law that outlines requirements for collecting, storing, and managing personal data for organizations within the European Union (EU) and organizations outside the EU that target EU citizens [3]. The participants will be informed about the collection, use, storage, and management of their personal data through a consent form, which they will need to agree to prior to data collection. To ensure the protection and privacy of the participants, all personal data will be deleted within a month after the thesis has been approved and published.

Another potential issue that may arise among users and participants during data collection is the feeling of being monitored while their tools are connected to the service, which could lead to negative attitudes toward the project. According to McParland & Connolly [4], if issues like this are left unaddressed, they could significantly impact the relationship between employees and employers, leading to negative attitudes and counterproductive behaviors. This is something the project group will need to keep in mind, as the interviewees in the study include both managers and employees.

In UX design, it is crucial to make both the product and its content accessible to diverse user groups. Therefore, Web Content Accessibility Guidelines (WCAG) will be utilized throughout the project to ensure accessibility. In short terms, WCAG is an international standard, created by W3C, with the aim of establishing a unified global standard for web content accessibility that meets the needs of individuals, organizations, and governments [5]. These guidelines is further explained in section 3.3.3.

# 2

# Background

This chapter provides a more in depth-view to the subject, including an introduction to target group tree professionals, fleet management systems, the already existing system Husqvarna Fleet Services™, related studies and other related existing solutions in the industry.

## 2.1 Tree Professionals

In the following section the target group *Tree professionals* is explained. This group consists of two types of professionals: *arborists*, working in urban forestry, and *loggers*, working within harvest forestry [6]. A common characteristic of the two occupations is that both are physically demanding and often involve risks. This demands trust in both their tools and team members to ensure safety and security.

### 2.1.1 Arborists

Arborists are tree care professionals and work primarily in urban forest systems, such as parks and gardens [7]. Their main task is to maintain healthy forests by overseeing the planting, pruning, and removal of trees. Expertise in tree biology and diagnostic methods is essential for arborists in identifying hazardous trees and determining appropriate solutions [8]. The job demands significant physical strength and dexterity, together with the ability to manage psychological stress during high-risk tasks, such as climbing and falling trees [9]. Before starting a job, arborists are required to perform a risk assessment to recognize potential risks [10]. In their daily tasks certain equipment and tools are essential, such as climbing gear, protective gear, communication devices, smart digital solutions, battery charges or/and fuel refills, lubricants, cutting and maintenance tools, and of course chainsaws for height and ground work [6]. When working at height, arborists use a specialized chainsaw with a top-handle design. Typically arborists use a variety of tools and many arborists are transitioning to battery-powered products [11].

### 2.1.2 Loggers

Loggers play a central role in resource production and forestry [12]. For loggers, professional tasks include tree felling, transporting trees from the stump to the delivery point (skidding), and delivering them to mills. Additionally, they must recognize risks associated with their work, such as identifying hazardous trees, and risks related to felling, delimbing, bucking, debarking, chipping, skidding, yarding, loading, unloading, and transporting logs [13]. Unlike arborists, who earn their income by maintaining the health, safety, and aesthetics of trees, loggers generate their income through the sale of timber. This is typically achieved either by purchasing stumpage (standing trees) from landowners, harvesting the trees, and selling the timber to a mill, or by operating under a contractual agreement with a mill or landowner to harvest their timber [12]. Certain equipment and tools are essential in their daily tasks, including protective gear, communication devices, smart digital solutions, fuel refills, lubricants, cutting and maintenance tools and the key petrol chainsaw, along with other saws such as forestry cleaning saws [6].

## 2.2 Fleet Management Software

Fleet management softwares are computer-based softwares designed to facilitate tasks related to managing fleets of motor vehicles [14] and equipment [15], often operated by businesses, governments or organizations. The use of fleet management software have increased significantly in the recent years [14]. The primary benefit of a fleet management software is its ability to measure and enhance fleet performance, ensuring efficient operation and maintenance [15].

## 2.3 Husqvarna Fleet Services™

Husqvarna Fleet Services™ is a service provided by Husqvarna Group for professional landscaping and ground care businesses to manage their equipment [16]. Currently, users have access to a mobile and tablet application as well as a web platform [17]. The only feature that differs between the platforms is the possibility to scan a product code with the camera to add products when using the mobile application [11]. Tracking sensors can be installed on any type of equipment, regardless of whether it is a Husqvarna product [16]. However, the quality and detail of the collected data from external equipment may be reduced. The sensors detect electromagnetic fields from battery operated products and the rotational speed of petrol operated products [18], allowing the system to track the machine usage in engine hours, and calculate the amount of time until the next recommended service appointment [16]. This enables users to set maintenance notifications, preventing unexpected breakdowns. Shown in Figure 2.1 is the external Husqvarna Fleet Services™ Machine Sensor that can be mounted externally on all types of machines and shown in Figure 2.2 are the internal Husqvarna Fleet Services™ Machine Sensor that currently can be mounted internally in some Husqvarna products.

Figure 2.1: External Husqvarna Fleet Services™ Machine Sensor [19]

Figure 2.2: Internal Husqvarna Fleet Services™ Machine Sensor [20]

Maintenance can then be recorded in the digital service log within the application [16]. The equipment can be tracked on the map in the app through the last known position where the mobile device and a gateway was connected. The gateway is required, typically mounted in a workshop or on a car, uploading data when products are in an accessible range. The app shows machines current status, enabling remote detection of potential issues. Husqvarna Fleet Services™ also provides users with insights into their business, including details on which equipment is being used, usage trends for different machine families over selected time periods, and the carbon footprint. All data is downloadable and can be integrated into the user's business system. The robotic lawnmowers by Husqvarna come with built-in connectivity from production and do not require an additional sensor [16]. However, most of the product range does need an additional sensor to enable connectivity to the service.

Currently, the primary user group of Husqvarna Fleet Services™ are robotic lawnmower customers, followed by big landscaping corporations that own numerous products. Few arborists use the service, mainly because they tend to keep careful track of their tools and are therefore not in need of an additional management system [11]. There are three roles within the service that can be applied on users. *Managers*, that have full access and can monitor the fleet, insights, manage settings and add new users [21]. *Technicans*, taking care of machine installations, service logs, maintenance, firmware updates and are having full access to functions regarding machines and machine performance. Lastly, *Operators*, accessing machine status and handling basic machine controls and error messages.

Shown below in Figure 2.3 and Figure 2.4 are screenshots found in *Professional products and services 2025* [21], a catalog published by Husqvarna AB (publ) in 2025 of the current Husqvarna Fleet Services™ application. On the left in Figure 2.3, the *Inventory Control* page is displayed, where the user can view all equipment and their quantities, as well as assign appropriate names to the equipment [21]. In the center, the *Tags* page enables the user to categorize equipment, such as associating them with teams or locations. On the *Machine Location* page to the right, the user can navigate the map to find the location of the equipment when a connection last was established between the gateway and the Husqvarna Fleet Services Machine Sensor.

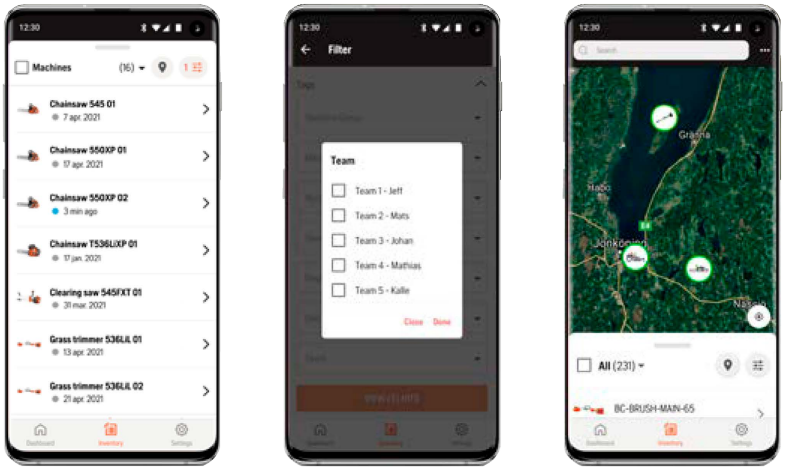


Figure 2.3: Husqvarna Fleet Services™: Inventory Control, Tags and Machine Location [21]

In Figure 2.4, the *Machine Statistics* page is displayed on the left, where the user is provided with data on engine hours and usage for each machine, as well as the ability to create a more detailed workday log. In the center, the *Service Overview* page provides the service history for each machine, making troubleshooting easier and managing service reminders. On the right, the *Connected Batteries* page allows the user to check the charging level, usage statistics, and battery health of equipment equipped with Husqvarna Group's connected batteries with built-in Bluetooth®.

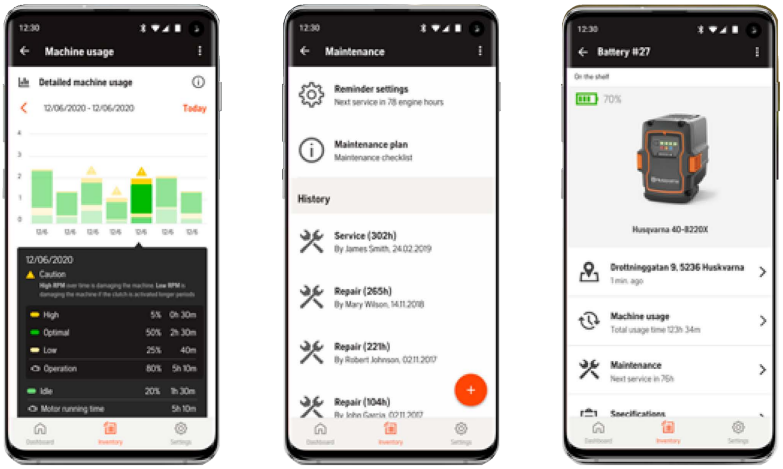


Figure 2.4: Husqvarna Fleet Services™: Machine Statistics, Service Overview and Connected Batteries [21]

## 2.4 Related Works

This section discusses studies related to the project, followed by a description of existing solutions.

### 2.4.1 Related studies

The studies related to the project were executed in the United states and Germany with a focus on how technological support is used among foresters in the two countries. No evidence was found for any similar studies made in Sweden, or for any studies focusing on how the insights could be applied to interaction design solutions.

The study conducted by Bettinger, et. al. [22], aimed to investigate how digital technologies are used and could be used among foresters in the states of Alabama, Michigan, Mississippi, New Jersey, and North Carolina in the United States. A digital survey was conducted and sent to foresters in the areas. The survey showed that about 50% of private forest landowners do not use digital technologies to support them with forest management. This was found to be due to lack of ease of use and applicability together with concerns about cost and training. The survey showed that foresters working for forestry organizations use digital technologies more often to receive support in their management tasks. The desired technologies within this group were smartphone applications, inventory systems and Geographical Information Systems (GIS).

Wever et. al. [23], conducted an analysis of how smartphones and tablets are used by German foresters in their profession. To address the growing adoption of digital technologies and the lack of research to which extent mobile devices and forestry related apps are used in German forestry a survey was conducted and sent out during 2021 and 2022. The survey was sent out to private, municipal and state-owned forestry companies. The findings suggest that state-owned and municipal forestry companies are marginally ahead of private organizations in digitization, which could be an effect of having better resources as a larger company. It is a growing trend in digital support in German forestry, but training, education and improved accessibility are needed to reach widespread adoption of digital platforms.

### 2.4.2 Existing solutions

Husqvarna Connect is an app for residential customers of Husqvarna products [24]. Similar to Husqvarna Fleets Services™ it is possible to gather products in the app. In Husqvarna Connect the user can see operating hours and other data such as battery status for battery products and fuel status for fuel products. The app contains guides and manuals to ensure that customers have easy access to help. It also gives notifications about errors and when it is time for service. Husqvarna Connect shares many features with Husqvarna Fleets Services™ but with the advantage of presenting guides and help, as well as the possibility to buy spare parts.

There are several related fleet management apps in addition to Husqvarna Fleet Services™ and Husqvarna Connect. The german company Sthil has two similar

applications, *Stihl connected* and *My Stihl* linked to their own chainsaws and machines. *My Stihl* is made for the residential user containing digital manuals of the saved machines, step by step guides, and retail information [25]. *Stihl connected* target tree professional and companies with large machine fleets [26]. In the app, it is possible to get an overview of all machines and batteries and if they are connected to a specific team. In addition, it is possible to view operating hours and maintenance recommendations. By connecting a product by Bluetooth to a mobile phone, the latest GPS position of the product is visible on a map. Through the app, the user can connect with a retailer for further support. The app is primarily made for Stihl products, but it is possible to connect machines from other brands as well, but with less tailored functions. The Stihl apps have the advantage of using Bluetooth instead of a gateway, which is used in Husqvarna Fleet Services™.

Arboreal offers several apps developed for arborists. *Arboreal Tree Height* uses Augmented reality (AR) technology to enable tree height measurement [27]. It is also possible to calculate the angle of tilt and canopy width of trees within the app. *Arboreal Forest* is an app developed for more extended forest management [28]. The app uses AR and LiDAR (Light Detection and Ranging) to measure different forest parameters without the need for traditional tools, including measuring the diameter and height of a tree, identifying wood species, and calculating the basal area and trees per hectare in a forest. The key of these applications is that they use the mobile phone camera to collect data. The Arboreal apps contain several features that could be useful for arborists during planning and preparation.

Scannable is a company that has clients in different areas where climbing is involved and Arborists are one of their target groups [29]. Scannable utilize NFC tags that can be placed on climbing equipment. The tags can then be scanned with the Scannable app to register that the equipment has been checked and is safe to use. In the app, all climbing equipment with tags can be gathered and it is possible to find information about when inspection is needed, together with information about the products such as serial number and manufacturer. By using NFC tags, Scannable enables easy inspection tracking which is an advantage compared to Husqvarna Fleet Services™ where service of products is manually recorded.

# 3

# Theory

In this chapter, the theory with relevance to the study is presented. This includes human computer interaction and theory related to interaction design, such as usability, design systems, accessibility and visual interface design principles.

## 3.1 Wicked problems

Apart from science, design addresses another type of problem, so called wicked problems [30]. According to Rittel and Webber, a wicked problem has conflicting perspectives which cannot be addressed accurately by using approaches of engineering or science [31]. In science, so called tame problems can be checked by other qualified person. For wicked problems the solutions are neither true or false, but rather good or bad, since the opinions and judgment of the often many different interested stakeholders may differ. Wicked problems cannot be fully solved, but can be managed using iterative and collaborative processes aimed at identifying the common good [32].

## 3.2 Human Computer Interaction

Human Computer Interaction (HCI) concerns improvement of interaction between computing devices and users [33]. The improvement focuses on more user-friendly interactions and about being more adapted to the user's needs and capabilities. There is no precise definition of HCI, but the user should have a more central role than the software or computer hardware itself. By integrating HCI into a design process, the user experience design can be significantly improved, leading to more effective, enjoyable, and satisfying user experiences.

## 3.3 Interaction Design theory

Below the design theory used in the study is described, including guidelines for usability, design systems, accessibility, and visual interface design principles.

### 3.3.1 Usability

Usability is partly defined by learnability, which refers to how easily a user can understand and accomplish tasks when encountering a new interface or design [34]. Further, it refers to how efficient a design can be used once a user has learned the design and how satisfactorily it is to use. Memorability and errors are also components that are important in assessing good usability. According to Jordan [35], usability is about giving users control over products that will improve quality of life.

### 3.3.2 Design Systems

Design systems are collections of elements that embody a company's or organization's digital identity and design principles [36]. The systems consists of predefined and reusable components such as color palettes, typefaces, forms, and buttons to create a uniform user interface. A design system enables collaboration between different teams in an organization ensuring that everyone follows the same design standards [37]. A challenge with design systems is to make them flexible enough to be appropriate for diverse products [38]. Furthermore, a design system requires updates to match the development of the products and to ensure that the system is still relevant.

### 3.3.3 Accessibility

Accessibility in UX design refers to developing digital products or interfaces that people with various disabilities can use, ensuring that interaction can be executed effectively [39]. According to WHO (World Health Organization), 16% of the global population is estimated to have various disabilities [40]. The environment and the level of social acceptance influence the experience of different disabilities. By using different guidelines and regulations when designing in digital environments, good accessibility can be reached.

Web Content Accessibility Guidelines (WCAG) provides a collection of guidelines to ensure accessibility for people with disabilities on the web [41]. The guidelines are designed to help individuals with visual, physical, auditory, speech, cognitive, language, learning, and neurological disabilities. WCAG is built on the four principles; Perceivable, Understandable, Operable, and Robust, which are further divided into achievement levels, A, AA, and AAA, where AAA is most accessible [42]. It is common for organizations to strive for level AA [43].

### 3.3.4 Visual interface design principles

Humans have a powerful ability to process large quantities visual information by recognizing patterns within it. This is advantageous to take use of as a designer, and in the book *About Face* by Cooper et.al. [44] this knowledge has been considered in their *Visual Interface Design Principles*, which describes how user interfaces should be designed [44]. These principles are presented below:

### Convey a tone/communicate the brand

Interactive systems are increasingly becoming a way where customers experience brands, therefore an interface should demonstrate the brand identity, without overriding the user goals [44]. A company should have a well-articulated brand promise that matches the entire product line to be able to convey trust and offer a good experience to customers.

### Lead users through the visual hierarchy

In the process of designing sets of visual elements in an interface, it is important to establish a hierarchy among the components [44]. Establishing a hierarchy enhances the user's ability to comprehend the interface and efficiently locate desired information. Hierarchy can be designed by using basic visual details such as color, size, and position. The most important element should be clearly distinguished from other parts by being larger, and positioned above less important elements, together with having a greater contrast in relation to the background.

### Provide visual structure and flow at each level of organization

Visual elements can be placed in groups by using spacing and the same visual properties [44]. Groups are beneficial when elements share the same type of function or present similar data. Grouped elements can be aligned to a grid, both vertical and horizontal. A grid system can facilitate the creation of visual elements across disparate interfaces, achieving a well-balanced composition that enhances user efficiency. Additionally, the layout should follow a logical path, which is from top to bottom, and left to right for Western users.

### Signal what users can do on a given screen

It should be clear by looking at a visual design for the first time what functions a digital interface holds. This is a principle of affordance, which can be achieved by using icons and visual symbols to convey the user what the result will be [44].

### Draw attention to important events

When the goal is to draw attention to a certain function or component, the use of contrasting elements is fundamental [44]. It can be a contrast of color, size, and motion. The two challenges with drawing attention are that it should not appear to be manipulative or rude, along with not overriding the design system and experience of the digital platform with exaggerative elements.

### Minimize the amount of visual work

In the context of an interface, it is advantageous to reduce visual noise that detracts attention from essential elements and information [44]. Visual noise can be a weak visual hierarchy, use of too many colors, and intense colors. It can also be unnecessary 3D renderings without information or crowding of elements.

**Keep it simple**

Visual interfaces should aim for minimalism, with simple forms, few typefaces and well-balanced color palettes [44]. By taking away visual elements it is possible to see if their contribution was important for the design.

### 3.3.5 Color theory

Colors can evoke emotions and induce behaviors [45]. High saturation and color contrast can trigger positive emotions as well as influencing cognitive processes linked to color affordance. Color affordance refers to how certain colors imply functions or meanings such as red being a signal for danger [46].

The choice of color palette and use of certain colors will affect the user experience and accessibility of an interface [47]. Using colors based on scientific evidence can improve readability and contentment compared to choosing a color palette based on personal opinion. Color contrast is important to achieve accessibility according to the Web Content Accessibility Guidelines (WCAG).

# 4

# Methodology

This chapter describes the methodology used in the study following the double diamond process and motivations for why other methods connected to design studies were not as relevant for the project.

## 4.1 Design process

This section explains the design process Double Diamond used in this study, as well as the design processes Research through Design and Human centered design, and why these were not used in the study.

### 4.1.1 The Double Diamond

Double Diamond is a design process represented by divergent and convergent thinking throughout the four phases: discover, define, develop and deliver, which is visualized in Figure 4.1 [48]. The clear stages ensures that each phase is thoroughly explored in an efficient way before moving onto the next step. The process empathizes making, testing and iterating in all stages, which makes it possible to discover underlying problems early in the process. Double diamond is a user-centric method that involves the users during the entire process with the aim to understand and address user needs, and further collect feedback from them to evaluate how well the solution fit their needs [49]. This is a suitable design process for the project to be able to answer the research questions that are strongly connected to the needs of the users. The importance of iteration in this project also argues for that the method is suitable since iterating helps creating solutions that are more aligned with the expectations and requirements of the users.

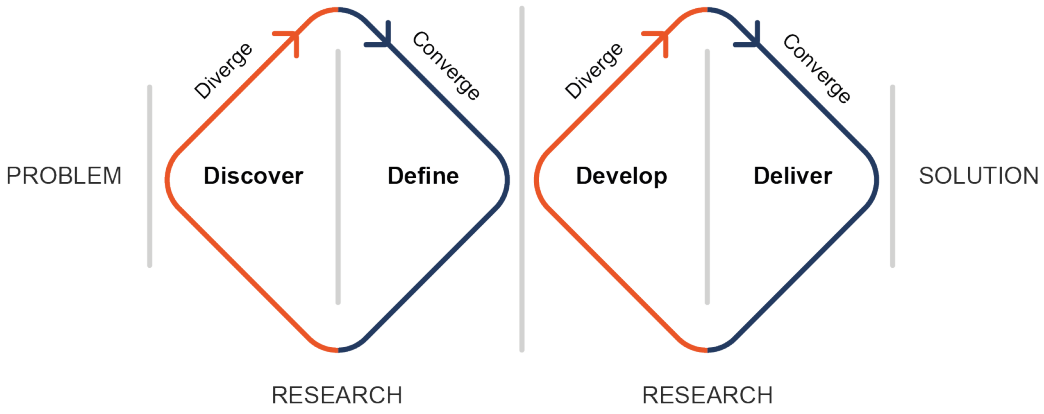


Figure 4.1: The Double Diamond design process

### 4.1.2 Other processes and approaches

Research through Design (RtD) is an approach in which design practice is used as research, and aims to change the current state of the world to a preferred state by involving wicked problems [50]. RtD fits well with wicked problems because it is more exploratory and fluid compared to scientific research [51]. However, double diamond was chosen over Research through Design as the design process because it has more structured steps with continuous iteration throughout the process [49]. Furthermore, double diamond emphasizes user-centered design by involving steps of understanding and addressing user needs together with feedback from users, which was critical for this project.

Human centered design (HCD) is another approach in which users have an active involvement during the development of software applications [52]. The user needs and requirements, as well as the context of use, should be understood during the process to be able to achieve usability. Both Human centered design and Double Diamond is user-centric and iterative design processes. However, Double Diamond focuses on divergence and convergence in each phase which fits well into a project involving ideation, prototyping and user testing [49]. Additionally, due to the access and geographical distance to the users in this project this process would require more time than the project time allows. Thus, the Double Diamond process is better suited to guide this study and was chosen over HCD.

## 4.2 Discover

In the discover phase of the study design reviews, literature review, semi-structured interviews and observations were used to gather data from the user. These methods are explained in the following section.

### 4.2.1 Design Review

A design review is a usability-inspection method in which a reviewer examines a design to identify usability problems [53]. The intention was to gather an understanding of the current system and identify the biggest flaws during the first impression of the system.

Another review method is a walkthrough, in which a designer goes through and explains the system step by step [54]. The method is more time consuming than a design review and requires that the designers involved plan the walkthrough, which was not feasible for this project.

### 4.2.2 Literature Review

A literature review should highlight and summarize findings from previous research associated with the subject [55]. It can be used to acquire knowledge of the topic, and to be able to answer practical questions. It can also be used to gain theoretical expertise, vital for the study. A literature review should further present what is missing in current literature.

### 4.2.3 Semi-structured Interviews

Semi-structured interviews are often planned ahead in terms of a scheduled time and location [56]. It is one of the most commonly used sources for gathering qualitative data. In opposite, to an unstructured interview, semi-structured interviews are based on a set of prepared open-ended questions, allowing further dialogue between the interviewer and the interviewee.

Quantitative data collection methods, such as questionnaires, were not relevant for this project. Instead, qualitative methods such as interviews were more suitable, as they provide in-depth analysis, highlight differences in the overall picture, and can offer evidence for change, all of which were essential for the project's goals [57].

### 4.2.4 Observation

Observations can be used as a method when users cannot describe thoroughly enough in an interview or when the environmental context has an effect on the study [52]. Observational studies can be done either direct or indirect. Direct observations involve an investigator being present and taking notes during the task. Indirect observation can be done by recording on video-tape, and analyzed afterwards as the investigator is not present. The observer should attempt to be unobtrusive and only

interfere with questions that are needed for clarification purposes. In this study, direct observation was used primary since it would be too tricky to perform indirect observations in such dynamic work setting.

## 4.3 Define

The define phase includes methodology for structuring the data gathered in the discover phase and forming it into clear needs statements and a user requirements specification.

### 4.3.1 KJ Method

The KJ method is used to systematically organize unstructured information on a specific subject following a four step procedure [58]. The first step is *label making*, where data is collected, for example through fieldwork, and the findings are written down on labels. The next step is *label grouping*, in which the designers carefully interpret the meaning of the labels and group them together. So called, lone wolves, without any significant association in meaning with the other labels, might become key concept or can be merged into another group during a higher-level of label grouping. Once about two thirds of the labels have been grouped, the designers can start to create headers, one-line sentences summarizing the meaning of the groups. The third step is *chart making*, using symbols to express the the following relations among the objects: cause and effect, contradiction, interdependence, and correlation. Lastly, the final step is *explanation*, which involves forming a clear explanation of the chart, typically starting with a scenario of the problem. The KJ method involves creative thinking which was suitable for the project. Further the method is collaborative and allows diverse perspectives, leading to more innovative and comprehensive solutions [59]. The method also ensures that the most critical data is addressed thoroughly, which is important in user-centered design.

An alternative method is Thematic Analysis which is used to identify, analyze and address patterns from qualitative data [60]. The method is divided into a six step process. The steps involve getting familiar with the data and select quotes to be able to identify recurring patterns. The method involves coding of the data that then are organized into themes to be able to identify relationships. Models or diagrams can be utilized to understand the relationships between themes to lastly be able to develop a conceptual model that lays the ground for the answer to the research question. Thematic analysis is a method similar to the KJ method that analyzes qualitative data. Thematic analysis, on the other hand, is better suited for theoretical conceptualization where a systematic method is needed to answer the research question. In this project the research questions are dependent on a user requirement specification and a prototype as deliverables, and therefore the KJ method is better suited, and Thematic analysis was not used.

### 4.3.2 Needs Statements

Needs statements concisely define the design problem and specify the necessary changes in outcomes or conditions for resolving the problem [61]. It can be based on data gathered from stakeholders, contextual research, and academic literature. In this study, semi-structured interviews and direct observations serve as the primary basis for the needs statements. The needs statements should define the type of change that should occur without specifying how it should be achieved [61]. It is important that the need statements are not too specific, as this may over-constrain the design problem, but also not too broad, as that can make them too general to effectively address the actual problem.

### 4.3.3 User Requirements Specification

The main purpose of a user requirement specification is to document the needs and constraints gathered to guide the development of a system, consisting needs expressed by the stakeholders [62]. This study incorporates user requirements, which are high-level abstract needs based on the end users and stakeholders, typically written in natural language. In contrast, system requirements, that are more detailed and describe what the system should do, often written in formal language, are not used in the study, as this study prioritizes understanding user needs rather than their technical implementation. This user requirement specification is requested by Husqvarna Group and is thereby one of the deliverables.

Alternative methods for defining user requirements, such as scenarios, personas, and user stories, were not employed in this phase. Personas are fictive but realistic representations of the users with a focus on their characteristics, needs, and behaviors [63]. Scenarios are used to describe how users interact with a system in different situations to identify user behaviors [64]. User stories are short and simple descriptions of a feature written from the user perspective, focusing on the user needs and desired outcomes [65]. The decision to not use these methods was primarily due to the fact that these methods had already been used and created by Husqvarna Group and were utilized by the project group in the initial phase to gain an understanding of the users. Therefore, recreating them would have been both time-inefficient and excessive for this project.

#### MoSCoW

The MoSCoW method is used to prioritize and make involved stakeholders understand the importance of different requirements [66]. MoSCoW stands for *Must have, Should have, Could have,* and *Won't have. Must have* means that the requirements are essential and if they are not delivered, the entire project will fail. *Should have* is features or requirements that are nice to have if possible. *Could have* is also requirements that are nice to have but not as advantageous as the *Should have. Won't have* is not unimportant requirements but they will not be implemented in the scope. It is rather requirements to add to a wish list, and that can be considered in a later stage. In this project, MoSCoW was a good method to be able to understand what

requirements to focus on when ideating and designing, and in the end bring the most value to the users.

## 4.4 Develop

The following section describes the methodology used, including ideation methods, prototyping, and usability testing, as well as motivations for methods that were not used.

### 4.4.1 Brainwriting

Brainwriting is similar to brainstorming, but instead of expressing ideas verbally, ideas are written individually and explored as broadly as possible before sharing them [67]. This approach prevents individuals from being influenced by other participants' thoughts and ideas, as it is easy to be steered toward the same solution path.

Brainstorming is another ideation method to come up with ideas and solutions in a group [67]. The aim is to think as broadly as possible and come up with as many unique ideas as possible, preferably wild solutions, where participants are encouraged to think outside the box. Although brainstorming is widely used, research has shown that brainwriting can generate approximately 40% more ideas than brainstorming [68], therefore brainwriting was used in the study as the initial ideation method.

### 4.4.2 Crazy 8's

The Crazy 8's is a rapid sketching exercise designed to generate a wide range of solutions to a design problem [69]. Each team member starts by folding a sheet of paper into eight sections. A timer is then set for eight minutes, during which participants quickly sketch one idea per section either filling all sections or stopping when the timer runs out.

Role ideation methods such as Role Playing and Six Thinking Hats were also considered. However, since most of the requirements were common between the two target groups, and given that the project team consisted of only two members, the relevance of these methods was reduced. SCAMPER would have been a suitable alternative for the project, as it is effective for enhancing existing concepts, which in fact, Husqvarna Fleet Services™ is. Unfortunately, it is more time-consuming and given that the ideation method was repeated for all the remaining requirement groups, the quicker Crazy 8's was used instead.

### 4.4.3 Prototyping

Prototyping and user testing, with the latter explained in 4.5.1, are crucial elements of the iterative user-centered design process, enabling early refinement to ensure a positive user experience and alignment with the designer's intentions [70].

Low fidelity prototyping is a widely used method for developing concepts in traditional two-dimensional user interfaces [71], and is used to enhance understanding and advance design [72]. The method is valuable in the early phases of a project and can be constructed without a large investment in time and money. One of the use cases of a low fidelity prototype is to function as an initial step in proposing a design approach for a user interface [73]. In this project, sketches generated during the Crazy 8's constituted as the low fidelity prototypes, as well as the wireframes.

A wireframe is a type of prototype, in the form of a rough visual outline of a proposed application. It is focused on interaction flow and arrangement of elements without exploring content or design [74]. It is a key step in the user-centered design process, used to gather input and feedback from users before finalizing the design.

In opposite, high fidelity prototypes are interactive and have complete functionality [73]. This type of prototyping rather addresses navigation and flow issues, but also matching the design and user models of the system. With that in mind, high fidelity prototypes require more time and resources, making them suitable for later stages of the process when major design flaws have already been identified. The fact that Husqvarna Group already has an established design system with created mobile UI components in Figma, led to the project group rather focused on utilizing these, which made it efficient to create high fidelity prototypes.

In this project, the software Figma was used for the majority of the prototyping, additionally for structuring the data collection with the KJ method. It is a cloud-based real-time collaborative tool for designers, covering tools from brainstorming and wireframing to prototyping [75]. The prototyping functionality allows the designer to add interactions to the elements in the design, allowing user testing of the prototype on a mobile device, which was utilized in this study.

### 4.4.4 Design critique

A design critique involves analyzing a design and offering feedback on how well it meets its intended goals [53]. One type of design critique is the standalone critique, a session with the sole purpose of improving a design. This format generally includes two roles: the presenter sharing the design, and the critique providing thoughts and feedback on the design. This method was suitable in providing quick valuable feedback from experienced and knowledgeable UX designers at the company.

Another method of receiving feedback is a focus group. The core element of a focus group is the interaction between participants that can uncover deeper thoughts and insights [76]. The method requires a group of 6-12 participants which for this project was unfeasible, and therefore design review was chosen as the method instead.

### 4.4.5 Information Architecture mapping

The method Information architecture (IA) mapping is used to organize and structure digital content within a system to be able to enhance usability [77]. IA mapping can be done by displaying content within a system in a visual mind map structure where

the relationships between elements is illustrated as arrows. The use of IA mapping can address navigation issues within the system and further ensure that the system is intuitive and user-friendly.

Flow chart is another method for illustrating a system [78]. The method focuses more on the different steps of decision within a system, using specific symbols to represent different actions. A flow chart can be especially important in the process of programming a system. This study focuses on the design and structure of the application, therefore IA mapping is better suited.

## 4.5 Deliver

In the following section, the methodology used in the *Deliver* phase, such as user testing and System Usability Scale, as well as reasoning for choosing these methods over others.

### 4.5.1 User testing - Cooperative evaluation

Usability testing is a type of user testing and a research method that involves participants representative of the target group to evaluate how effectively the product meets the usability criteria [79]. The purpose of conducting usability testing is to ensure that the product is useful, valuable, easy and satisfying to use for the target audience while effectively helping them achieve their intended objectives. Cooperative evaluation is a method that is proposed to be used in the rapid development of products [80]. The user performs predefined tasks while thinking aloud. These tasks are often centered around features of interest that the designer would like to evaluate. The designer, knowing the prototype and its capabilities, acts as a moderator during the session. This method allows the designer to get quick and direct feedback on the design, while being cost-effective.

Validation test, which is another type of user testing, often conducted in the late stages of the development phase was not as appropriate to use for this project. It is designed to assess the usability of a product to confirm that previously identified issues have been resolved and no new problems have emerged [79]. One objective is to evaluate how all components of a product function together in an end-to-end study, such as assessing all steps of a workflow. The validation test primarily focuses on quantitative data, such as task completion effectiveness and error rates, while also identifying the underlying reasons for poor performance. Unlike, the cooperative evaluation, there is very little interaction between the participant and moderator and thinking aloud is rarely used. This method could rather be used in an even later stage, when a more complete system is developed than just an interactive Figma prototype of the user interface design. One reason is that the reliability of Figma in terms of running the prototype cannot be ensured, therefore not comparable to running an actual system. Another reason is that qualitative data, as gained from the cooperative evaluation is more useful at this stage. Consequently, the cooperative evaluation is utilized for the user testing.

#### Thinking aloud

One of the most straightforward methods to get information about participants' internal process when using a system is the thinking aloud method [80]. The basic principle is to ask users to verbalize their thought process when working on given tasks [81]. The method is shown to be effective for identifying usability problems in user interface design, especially in cases when the designers conduct the usability test themselves, as it allows direct feedback from the users [80].

### 4.5.2 System Usability Scale

The System Usability Scale (SUS) is a commonly used standardized tool for measuring perceived usability [82]. The usability scale was created by Brooke in 1986 and is a Likert scale, most often from 1-5, that consists of 10 items generating a subjective assessment of the usability of a system [83]. Typically, the SUS is applied after the respondent has used the system but before any discussion of the experience. It is the most widely used for the measure of perceived usability and is likely to remain so [82]. Findings show that the SUS has excellent reliability and strong concurrent validity in measuring perceived usability on various systems, including mobile applications.

The scale is ranged from *Strongly Disagree (1)* to *Strongly Agree (5)* and below are the items to be rated by the respondent.

- $Q_1$ I think that I would like to use this system frequently.
- $Q_2$ I found the system unnecessarily complex.
- $Q_3$ I thought the system was easy to use.
- $Q_4$ I think that I would need the support of a technical person to be able to use this system.
- $Q_5$ I found the various functions in this system were well integrated.
- $Q_6$ I thought there was too much inconsistency in this system.
- $Q_7$ I would imagine that most people would learn to use this system very quickly.
- $Q_8$ I found the system very cumbersome to use.
- $Q_9$ I felt very confident using the system.
- $Q_{10}$ I needed to learn a lot of things before I could get going with this system.

The SUS score ranges from 0 to 100, although it is not equivalent to percentage [84]. According to a study by Sauro, the average score in 500 evaluations was used to generate the distribution of all scores. Accordingly, a system with a score above 68 would be considered as obtaining above average usability, thus a score below 68 as below average. For a system to qualify in the top 10%, the average score would need to be over 80.3 and scoring an average of below 51 would placing the system in the bottom 15%.

Another method for measuring usability is Single Ease Question (SEQ). The method measures user satisfaction for individual tasks with only one question with answers ranging from *very difficult* to *very easy* [85]. As the method is focused on single-item measurements the full complexity of the system might not be captured. Therefore, SUS will be used instead of SEQ in this project since it measures the overall usability in a more efficient way than creating an SEQ for each function within the system.

### Calculating the SUS Score

The positive statements have odd question numbers (1, 3, 5, 7 and 9), while the negative statements have even question numbers (2, 4, 6, 8 and 10) [86]. As mentioned above the question score are ranged from *Strongly Disagree (1)* to *Strongly Agree (5)*. According to the formula, each score of a positive statements is calculated by subtracting 1, while each score of a negative statement is calculated by subtracting the score from 5. Finally, the the sum is multiplied by by 2.5 generating the SUS Score from that participant.

$$\begin{aligned} SUS\ Score = ((Q_1 - 1) + (5 - Q_2) + (Q_3 - 1) + (5 - Q_4) + (Q_5 - 1) + \\ (5 - Q_6) + (Q_7 - 1) + (5 - Q_8) + (Q_9 - 1) + (5 - Q_{10})) \times 2.5 \end{aligned}$$

# 5

# Planning

The project will follow the process of Double Diamond, explained in section 4.1.1. Accordingly, the planning presented in this chapter follows the structure of the phases: Discover, Define, Develop and Deliver [48]. Shown in Appendix A, is a more detailed timeline for the project, presented in the form of a gantt-chart, as well as the initially planned timeline, showing the differences of the planned timeline and the actual timeline of the project .

## 5.1 Discover

The aim of the discover phase is to understand the problem, context and target group of the study. Husqvarna Group introduced the initial problem statement and therefore an initial design review of the existing system Husqvarna Fleet Services™ will be conducted together with a literature review to gain knowledge of the initial state and the theoretical background. The research question aims to understand what the user needs are for the target group, hence interviews and observations will be held with arborists and loggers. The interviews will include questions to gain understanding about the professions, habits, use of other systems, problems, and wishes that can enhance their work situation. As an updated version of Husqvarna Fleet Services™ will be released during the thesis timeline a second design review will be conducted to gain understanding and identify improvement potentials.

## 5.2 Define

The purpose of the second stage is to define the scope of the problem together with the user needs and requirements to understand what is most vital for the remainder of the thesis. This will be accomplished by structuring the data from interviews and observations using the KJ method, which will help identify themes and relations among the expressed and observed problems. Needs statements will be used to clearly and concisely define the design problem within the structured data from the KJ method. A deliverable requested by Husqvarna Group for this phase is a user requirement specification that outlines what the target groups needs in a mobile application. Therefore, a user requirement specification will be created from insights and knowledge gained from prior methods where each requirement will be ranked with the MoSCoW method.

## 5.3 Develop

After defining what the requirements are, the develop phase will begin with ideation. First, brainwriting will be used to generate ideas. The Crazy 8's method will be utilized to further elaborate the ideas and create more defined concepts. The ideas will then serve as the foundation for the wireframes, which will be created to obtain a visual guideline for the following prototyping. A high fidelity prototype will be designed in Figma with use of typography, colors and other visual elements from Husqvarna's design system. The first prototype will be examined by experienced UX-designers to receive design critique and feedback for a second iteration. To get understanding of the user value and intention of each page within the prototype, an IA map will be created. Based on the design critique and IA mapping, elements in the prototype will be refined, resulting in a second iteration.

## 5.4 Deliver

The prototype will be tested by the end-users to understand the user experience and how well the solutions meet the user requirements. Product specialists at Husqvarna Group will also test the prototype to receive valuable feedback around features that might already have been a topic at the company. The test will be constructed with tasks combined with questions. User testing will be used together with the think aloud method to understand how the users complete a given task within the prototype. The questions will give detailed information about the user experience and the fulfillment of user requirements. Both the end-user testing and the product specialist testing will end with an SUS-questionnaire to get data on the usability of the system. After the conduction of user testing, a third iteration will take place to solve errors and improve features resulting in a final design. Finally, encouragements for future work will also be presented.

# 6

# Process and execution

The following chapter describes the process of the study and the execution of the methodology used. The chapter is divided into the double diamond phases; Discover, Define, Develop, and Deliver.

## 6.1 Discover

This section explains the process and execution of the design reviews, literature review, interviews and observations performed to discover the thesis subject and to collect data.

### 6.1.1 Design Review 1

To understand how the current system, Husqvarna Fleet Services™ as a mobile and desktop application worked, individual accounts were provided by the company. Navigating the Husqvarna fleet services as first-time users, insights were gained about how the system is introduced to new users. The design review revealed that the functionality of the system was not clearly communicated to the user through the design. The starting page did not signal what the user could to, and neither did it draw attention to any important events. Furthermore, functions did not work in an expected way, since whenever clicking on a product, one was directed to the map view instead of getting information about the actual product. This was discovered for both the mobile and desktop application. Later during the project Husqvarna launched an updated version of the app which will be explained in 6.1.4 Design Review 2.

### 6.1.2 Literature Review

A literature review was conducted to gain understanding and knowledge about relevant topics. The review concluded literature on the user group and the profession of tree professionals. Further, research about related works and studies was conducted to increase the awareness of the current situation. The literature review also included relevant theories and methods to get a clear direction in the process of the project. The literature review constituted the foundation for the background of the project as well as contributed to gained knowledge about relevant topics for

the project group. This gained knowledge made it possible to formulate a relevant interview guide.

### 6.1.3 Interviews & Observations

This sections explains the interviews conducted and observations in the cases where the opportunity to observe was possible. The interviews were conducted over a period of two and a half weeks, during February and March, and used the structure of semi-structured interviews. An interview guide was prepared based on the literature review and former findings from Husqvarna about the target group, which is shown in Appendix B. It covered the following areas: Work & Workday, Machines, Other Equipment, Communication & Collaboration, Problems & Challenges, Digital Tools and finally Important Information & Data. Prior to each interview the participants were asked to sign a consent form allowing the project group and Husqvarna Group to collect, use and keep the data until the project is considered finished by Husqvarna Group. All participants agreed and gave consent for their participation in this study.

In total, as shown in Figure 6.1, nine interviews were conducted, where five of them were arborists, and four of them loggers. Additionally, some participants also worked part-time as educators within the field. The interviews were conducted both in-person and digitally, depending on the travel distance for the project. A maximum single-route travel time of two and a half hours were set, mainly due to the limited data collection period within the time frame of the study. While out in the field, five people were observed, three arborists and two loggers, where four of them were interviewed. The other two in-person interviews were held in an office environment.

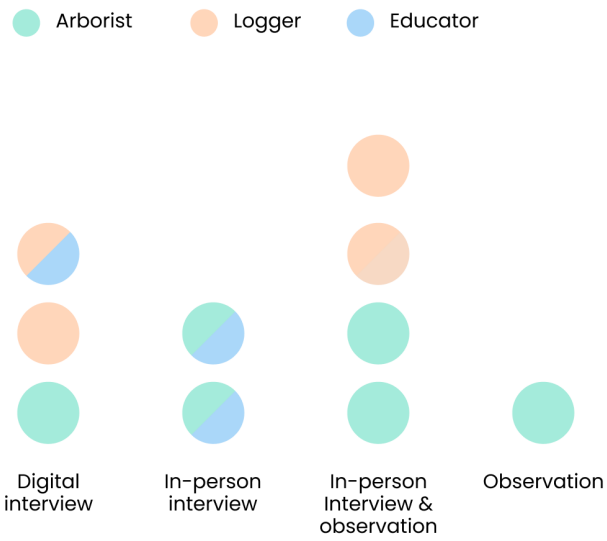


Figure 6.1: Illustration of participant roles and the user study methodology applied

The interviewees were all male, ranging from the ages of 28-67, with a mean age of 43 and a median age of 44. One women was observed, unfortunately an interview with her was impossible. All interviewees except one were based in southern or middle Sweden, where the exception operated in southeast Canada. All participants had an established connection, contact, or collaboration with Husqvarna Group and had prior experience testing and helping in terms of research and development related to products within their field. They were primarily contacted through phone calls, but also through mobile messages or emails.

During the interviews, it became apparent that the participants did not use the existing Husqvarna Fleet Services™, partly due to lack of knowledge about the system and partly because they did not find it valuable for their professions. The participants saw the existing service more as something they would need to maintain usage of without purpose, rather than something that would help them and simplify their work. The participants communicated needs and wishes that would make them use the system. Work related behaviors were observed and discussed during the interviews, which were valuable to understanding the users.

### 6.1.4 Design Review 2

During the study, a new version of Husqvarna Fleet Services™ was released, with an updated graphical user interface, therefore a second round design review was conducted. The updated version has a more united graphical interface and gives the expression of a modern and more elaborate application. Still, the functionality and user-value for tree professionals remain unclear when walking through the pages of the application. There are no significant differences in the functionality of the app, and it still does not signal what users can do. The application continues to be more tailored to serve larger companies with a large product fleet, where it is more important to see an overview of the products rather than having more product-specific solutions which could suit tree professionals. However, the new update provided some design elements, serving as inspiration for the ideation and prototyping.

## 6.2 Define

The define section explains the process and execution of analyzing the data using the KJ method and needs statement leading to the defining of a user requirement specification.

### 6.2.1 KJ method

The interviews were transcribed and together with the observations gave insights about the arborist and logger professions. It also provided information about problems and wishes. These insights were written on notes and organized into clusters. Firstly, some larger main domains emerged containing many notes, together with some smaller clusters with miscellaneous topics. The large domains were Additional apps & Digital services, Battery & Charging, Communication, Planning, Small vs. big company, Fleet services, Desired functions & features, Risks & Hazards, GPS tracking, Service & Maintenance, and Chainsaws. These clusters were then divided into more specific sub-themes.

The KJ method in Figure 6.2 shows the organized findings of the interviews and observations, written on colored labels. The green color represents arborists, the orange color represents loggers, and the blue color represents educators. Some of the participants possess both an educator role and a role as a tree professional and therefore have a multicolored label.

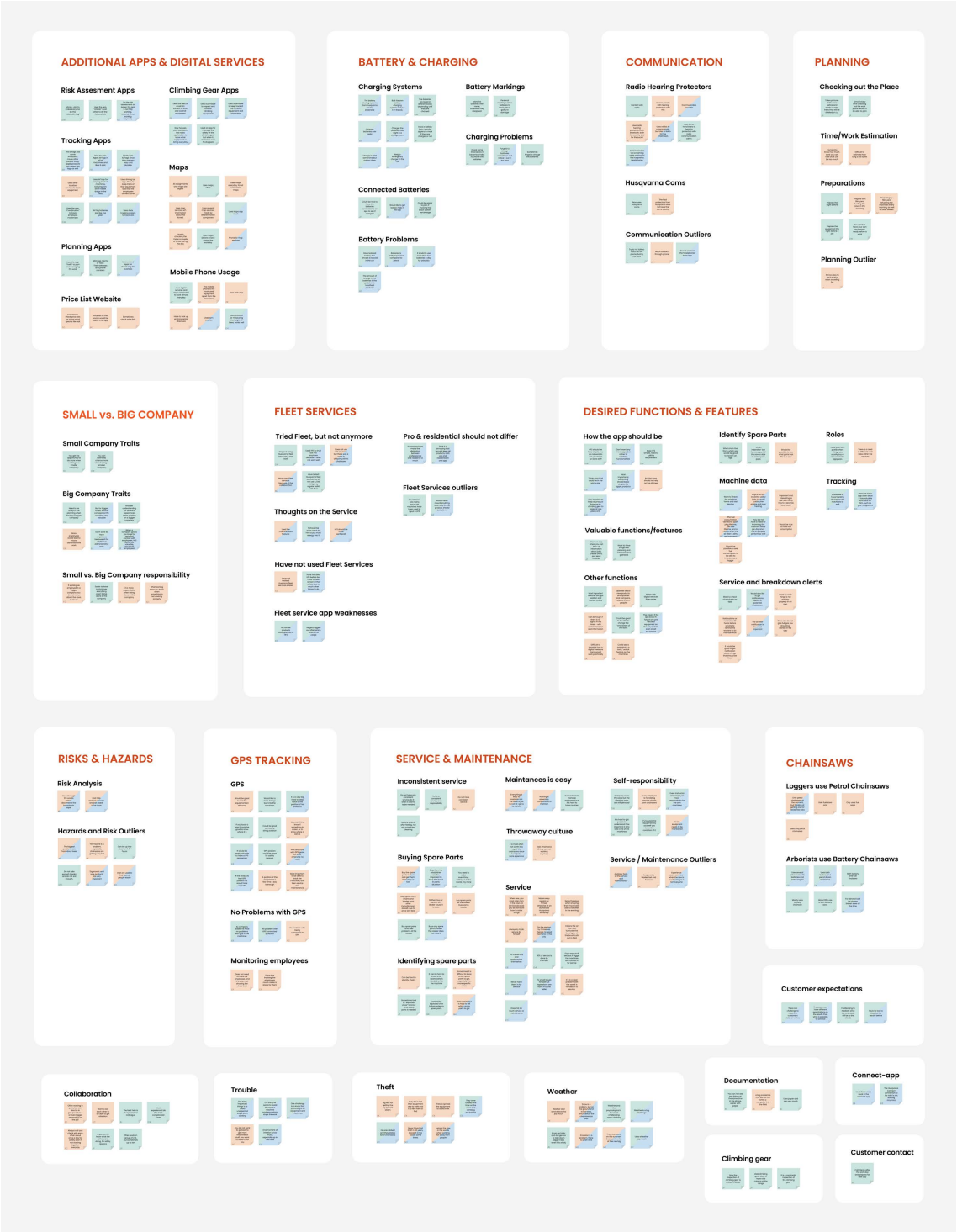


Figure 6.2: KJ method of the data from the interviews and observations.

The KJ method analysis contains information about the work of tree professionals and their problems and wishes, both related to a digital service and more general thoughts. To be able to formulate the needs statement, important themes and notes were highlighted in blue, which is shown in figure 6.3. The most important areas are marked with orange and consist of thoughts regarding Battery & Charging, GPS, Identifying and Buying spare parts, and Theft. The decision of which themes were the most important was based on which groups were the largest, as well as the things that were stated as most important by the participants during the interviews. All marked areas were brought to the following steps in the process, with the most important themes highly prioritized.


Figure 6.3: Prioritized themes from the KJ method. Orange is the most important themes, followed with the blue marked that was also interesting to proceed with.

### 6.2.2 Needs Statements

Presented in the following section are the needs statements of the identified feasible areas for this project, marked in orange and blue in Figure 6.3 above. The presentation does not follow any order of importance or weighting among the needs.

#### Common Needs

The following common needs statements, applied to both arborists and loggers, were created.

N1: Connectivity

---

Arborists and loggers require a built-in fleet sensor, providing information that is accessible in the field, allowing them to operate efficiently without dependence on digital connectivity.

N2: Machine Data

---

Arborists and loggers need to be able to monitor machine hours, fuel consumption, engine temperature, vibration levels and track the lifetime of critical components,to prevent unexpected breakdowns, maintain efficiency, and extend the lifetime of their equipment.

N3: Machine Position Tracking

---

Arborists and Loggers need an efficient system to track their machines and saws in real-time and alert them if any equipment is forgotten to prevent losses, reduce downtime, and ensure all necessary tools are available.

N4: Planning

---

Arborists and loggers need help in estimating the duration and price of a job, helping them avoid losing money on miscalculations.

N5: Preparations

---

Arborists and loggers need a system that helps them to prepare their equipment before starting work, ensuring all machines are ready and in working condition.

N6: Protection & Theft avoidance

---

Arborists and loggers need a way to protect and lock their machines and reduce the risk of theft to avoid work interruption and minimize costly losses.

N7: Risks & Hazards

Arborists and loggers need help taking adequate breaks, and a way to digitally perform risk assessments. They need a way to check up on colleagues to ensure safety and to be easily located in emergency situations.

N8: Service & Maintenance

Arborists and loggers need a way to ensure consistent service and maintenance, involving logging all service activities and track date of the last service. Helping them to avoid unexpected stops and providing notifications when a machine needs service, before potential breakdowns, and if something is not working properly.

N9: Spare Parts & Chain Identification

Arborists and loggers need a way to easily identify the spare parts required for their equipment and the correct chains for their saws to simplify maintenance and minimize downtime.

N10: Usabiliy & User Value

Arborists and loggers need a simple user-friendly fleet management system that gathers all the equipment while being valuable for both small and large companies.

**Arborist Specfic Needs**

Apart from the common needs, specific need statements for arborists were also created.

N11: Battery & Charging

Arborists need a dependable way to manage their batteries. This includes having enough fully charged batteries ready before work, informing about the exact battery percentages, and separating charged from uncharged batteries. They should also be able to distinguish personal batteries from others and maintain appropriate temperatures on the batteries to sufficiently work with the battery products.

N12: Climbing Gear

Arborists need a system to ensure the safety of their climbing gear and keep track of the inspection schedules, ensuring that all equipment is regularly checked and maintained.

N13: Customer Communication

---

Arborists need a way to communicate the expected results to customers, ensuring a successful outcome for both parties.

N14: Tree Height Measuring

---

Arborists need a way to measure tree height in order to prepare how the job should be executed.

### Logger Specfic Needs

Finally, one needs statement specifically for loggers was created.

N15: Log Sales

---

Loggers need an easy way to check price lists for different wood types and measure the log length, helping them to be cost-effective.

### 6.2.3 User Requirement Specification

Based on the needs statements more concise and clear user requirements were constructed in form of a user requirements specification. This was one of the requested deliverables by Husqvarna Group and was a helpful tool to have together with the needs statements in the following ideation phase. This was a living document through the process, meaning that it changed after its first version. However, the first version, created in this stage consists of 51 requirements divided into 15 groups. The following list presents the requirement groups, including the number of requirements each group contains:

**R1** Connectivity *(3 requirements)*

**R2** Machine Data *(7 requirements)*

**R3** Machine Position *(2 requirements)*

**R4** Planning *(1 requirement)*

**R5** Preparations *(1 requirement)*

**R6** Protection & Theft Avoidance *(2 requirements)*

**R7** Risks & Hazards *(3 requirements)*

**R8** Service & Maintenance *(7 requirements)*

**R9** Spare Parts *(2 requirements)*

**R10** Usability & User Value *(11 requirements)*

**R11** Battery & Charging *(5 requirements)*

**R12** Climbing Gear *(3 requirements)*

**R13** Customer Expactation Comuncation *(1 requirements)*

**R14** Tree Height Measuring *(1 requirements)*

**R15** Log Sales *(2 requirements)*

The final version of the user requirement specification is explained and presented in its totality in 7.1.

## 6.3 Develop

This section explains the development of a prototype, including the process and execution of the ideation, wireframing, design critique, information architecture mapping, and iterations of the prototype.

### 6.3.1 Ideation

Based on the findings from the prior data collection and data analysis, the ideation methods Brainwriting and Crazy 8's were used to generate potential solutions and concepts fulfilling these needs and requirements.

#### Brainwriting

The first ideation method used was brainwriting. For each requirement group, three minutes was used to individually write down ideas on paper. These ideas were then passed on to the other member of the group to develop and add additional ideas over a period of three minutes. Finally, the ideas were explained and discussed, and if these discussions generated additional ideas, they were written down on the paper as well. This process was executed 15 times, one for each requirement group to generate as much ideas as possible. A showcase of the brainwriting on three of the groups is shown in Figure 6.4.

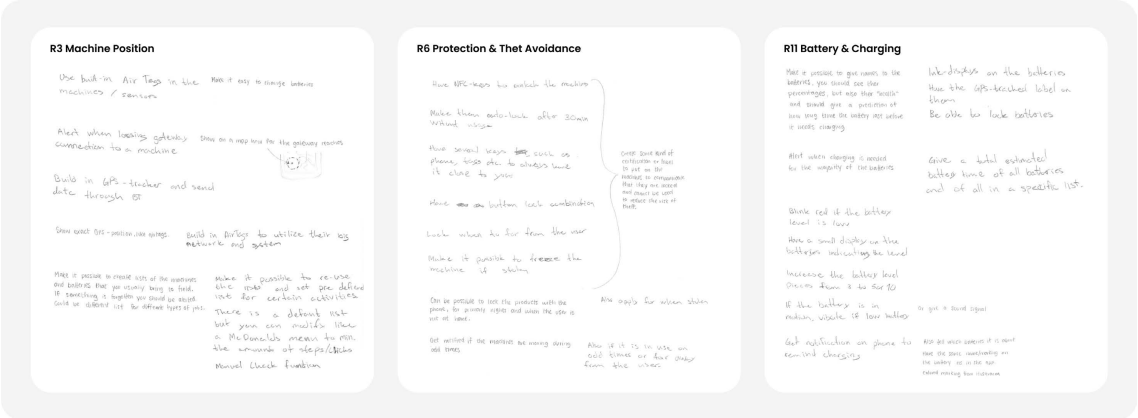


Figure 6.4: Brainwriting on the requirements within the groups *R3 Machine Position, R6 Protection & Theft Avoidance* and *R11 Battery & Charging.*

The session ended with a selection of the most promising and feasible ideas. This resulted in bringing 7 full requirement groups and parts from one requirement group to the next ideation method. The following requirement groups were eliminated from the process in this stage:

*R1 Connectivity* was eliminated since the ideas were related to improvements of the connectivity system and the machine sensor rather than the application and its user interface. *R4 Planning* was eliminated since the ideas were few and there are already a lot of existing solutions related to planning of workdays on the market fulfilling the

user needs. Part of the *R7 Risks & Hazards* ideas were eliminated since they were not related to a mobile application. *R12 Climbing Gear* was eliminated since the already existing solution Scannable is fulfilling the user needs very well. In this case a recommendation of a collaboration between Husqvarna Group and Scannable is proposed instead. *R13 Customer Communications and R14 Tree Height Measuring* were eliminated since the ideas were all connected to creating 3D-mappings of the trees, which is far from the service Husqvarna Fleet Services™ and would be more suitable as its own application.

### Crazy 8's

Based on the ideas generated during the Brainwriting, as motivated above the most promising and feasible requirement groups were taken in to the next ideation method, Crazy 8's. For each requirement group eight minutes were used to generate up to eight ideas on one paper. Some papers consist of less than eight ideas where lack of time or ideas was the cause. The ideation resulted in 15 sheets filled with ideas presented in its totality in Appendix D. Three of the groups are presented in Figure 6.5 below, showing a combination of sketched mobile screens and product doodles.

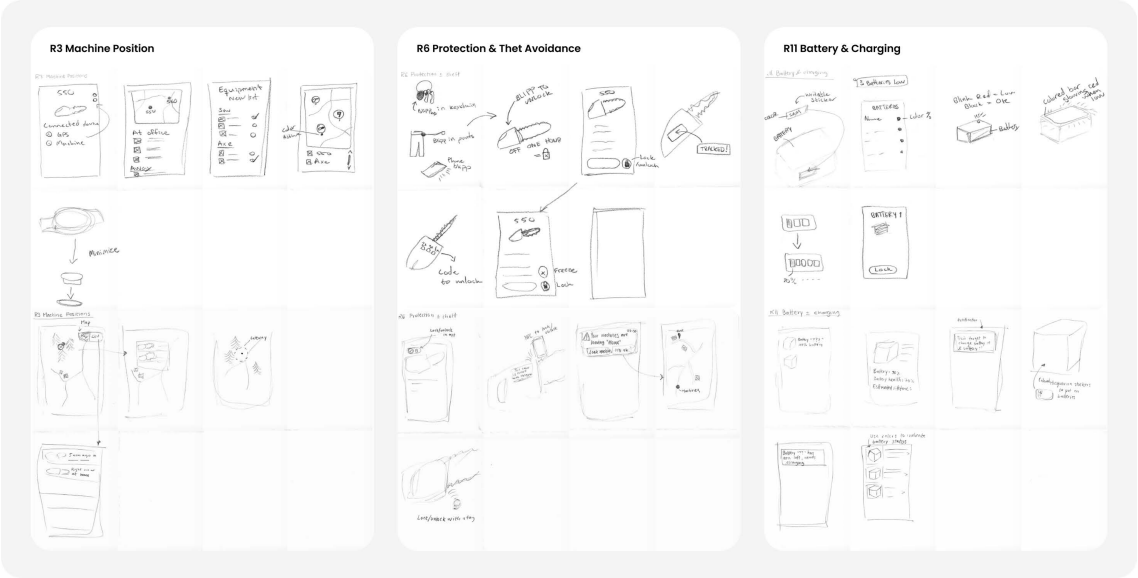


Figure 6.5: Crazy 8's on the requirements within the requirement groups *R3 Machine Position*, *R6 Protection & Theft Avoidance* and *R11 Battery & Charging.*

Using the same strategy as in the brainwriting, some ideas was prioritized for the prototyping, mainly to narrow down according to the project scope. In this stage, *R15 Log Sales*, containing the only logger specific requirements, was discarded as the ideas for it was considered to be too far from the scope Husqvarna Fleet Services ™, and would rather be suitable in its own application or service. The prioritization was made by deciding what ideas were feasible within the scope of the project, as well as clearly connected to Husqvarna Group, which is presented in Appendix D. The most important needs stated in the interviews were also considered in the prioritization.

### 6.3.2 Wireframing

Quick wireframes were created based on the ideas and sketches generated, firstly to function as a brief visual guideline when prototyping, but also to evaluate the potential layout before starting the following high fidelity prototyping. It partly resulted in the idea of increasing the navigation bar to five tabs instead of the three in the actual Husqvarna Fleet Services™, giving the application a better structure, allowing the user to navigate more easily. Hopefully, also giving each tab a more distinct purpose to make it easier for the user to know what to do in the app, as it was discovered to be a problem in the current application during the design reviews. The wireframes also created the base layout of the application, shown in Figure 6.6. The left screen is a product page where a big product imaged is displayed together with widgets, presenting information such as GPS-position, machine data and service information. To the right a product list is shown using cards to separate each product and a horizontally scrollable menu for filtering the products.

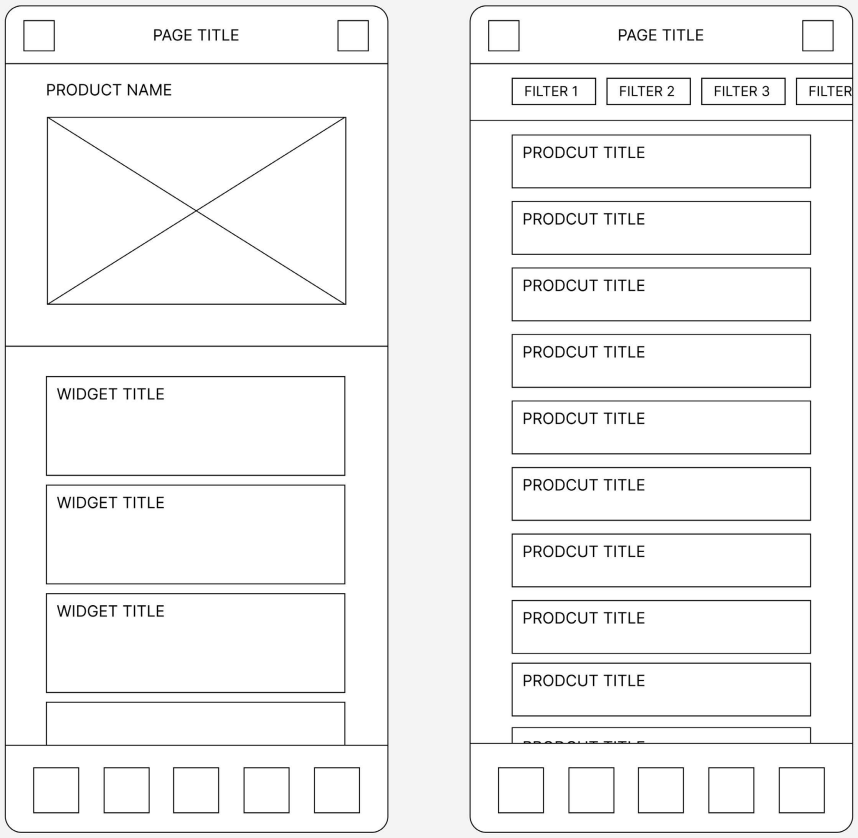


Figure 6.6: Wireframes of the product details page and the products list.

### 6.3.3 Prototype - First iteration

The first iteration was about transferring the ideas from sketches, wireframes and thoughts to a graphical representation. Husqvarna Group already has an established design system, with components and styles, that were encouraged to use. Therefore not much low fidelity prototyping was created apart from the Crazy 8's sketches and wireframes. The reason behind this is that since the components and design system already was established there was not much to gain from it, and it was recognized that it would be more time consuming than what it would bring value to the project. Shown in Figure 6.7, the first iteration features a navigation bar consisting of five main tabs, each described below.

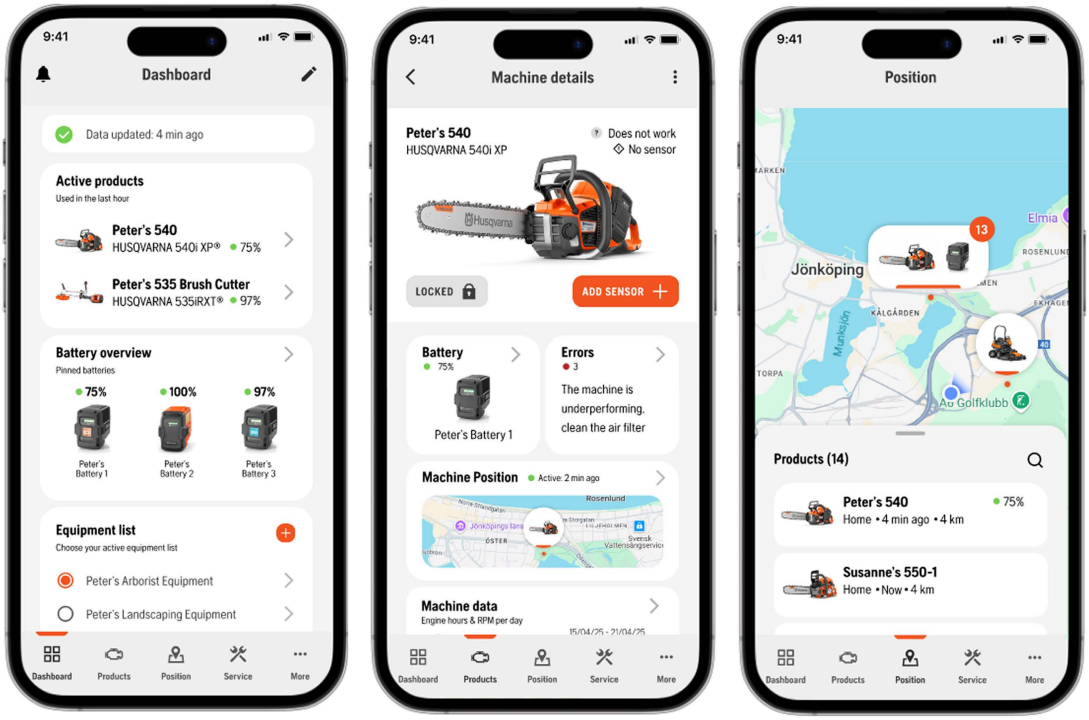


Figure 6.7: Figma Prototype - Iteration 1.

*Dashboard* - the page that the user arrives at when entering the application, except if it is the first time using the application or if the user needs to log in. This is a customizeable page, in which the user can add widgets of their choice to best adopt it for their needs. The idea is that it should provide quick information, such as a widget of the last used product, a battery percentage overview of pinned batteries or a high priority service overview. There is also a widget for equipment lists where the user can activate a list containing products they usually bring on different jobs to enable reminders for sets of products.

*Products* - displaying all connected products in a list view. Here, the user can filter, sort, and search for specific products. This is also the place to add a new product in the app. When selecting a product in the list, the user arrives to the specific machine details page, shown in the middle of Figure 6.7. This page gives an

overview of all information related to the specific product, such as position, machine data, what battery that is connected, errors, and service information. There are also details about the batteries which is similar to the machine details, but additionally provides information about battery level and battery capacity. Additionally, there is an option to add labels to each battery, which can help the users separate the batteries from each other in the working environment and get a clear overview in the app.

*Position* - providing the geographical position of every product through a map view, shown to the left in Figure 6.7. The user can select a specific product to get more detailed information, including address, coordinates and a shortcut for directions. There is also an option to lock/unlock a product on the position page or in machine details.

*Service* - displaying all connected products in a list view, but more focused on service and maintenance on the products. In this page, the user can filter on service priority, as well as sort on the last and most current serviced products. When selecting a product, the user arrives to the product's specific service page getting more detailed information related to service and maintenance. It also allows the user to log service or maintenance activities or access spare parts. The spare parts page consists of exploded views of the specific product where it is possible to find the article numbers of all spare parts.

*More* - gathering information related to the user profile and its team. It also provides the settings page, legal information, news and the option to log out from the application.

### 6.3.4 Design critique

During a 30 minutes session, the prototype was reviewed by two experienced UX designers from Husqvarna Group. They provided valuable insights before the next iteration of the prototype. One of the most important takeaway from the session was that having three similar list views on the products, position and service tabs could be confusing for the user. Furthermore, design system deviations were discussed as well as if there might be too many features within the prototype. Finally, some already existing features and solutions on other Husqvarna services were explained to us, such as Husqvarna Service Hub where retailers can search and find spare parts for products, and how we could take advantage of and inspiration from them in the prototype.

### 6.3.5 Information Architecture mapping

The insights gained from the design critique session about thinking through each page once more, what the intention is and what value it brings the user, resulted in creating an IA map. The reason was to get a better overview of what the user achieves in each page and how the structure and the user flow in the prototype could be improved.

The IA map, shown in Appendix E, was created in FigJam using boxes for each action that the user can take on each page, and arrows indicating the connection between the actions, visualizing the user flow. In the IA map it became clear that the service page was unnecessary for the application since the pages and functions reached from it were also easily and intuitively reachable from the product page. The battery and error widgets on the product details page were also found to be unnecessary, since they were duplicates and could already be reached on other pages. These findings were marked by using red boxes in the IA map. The method provided a valuable overview of the prototype and functioned as a framework for the changes in the second iteration of the prototype.

### 6.3.6 Prototype - Second iteration

The second iteration was about thinking through the prototype, ensuring that the features in the prototype fulfill the user needs as intended. One of the main changes was combining the products tab with the service tab, reducing the amount of pages and thereby the amount of lists, to make the application easier to understand, and reduce confusion between otherwise similar looking pages. This implied a change in the navigation bar, shown in Figure 6.8. Additionally, the former more tab was renamed to profile to better represent what the user can expect when pressing it.

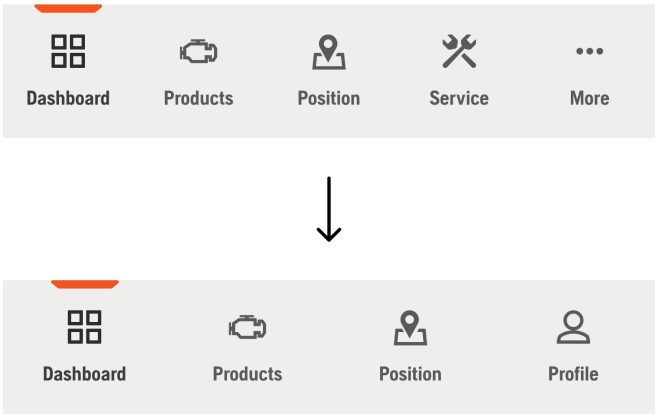


Figure 6.8: Changes in the navigation bar from iteration 1 to iteration 2.

Within the product page in product details, some changes were implemented, such as the battery, error and service & maintenance widgets. The error widget was excessive due to the service & maintenance widget on the same page, taking the

user to the same destination, and was therefore combined into one widget as shown in Figure 6.9. The battery widget was discarded from the page since discussion regarding what value it would bring to the user was vague and uncertain.

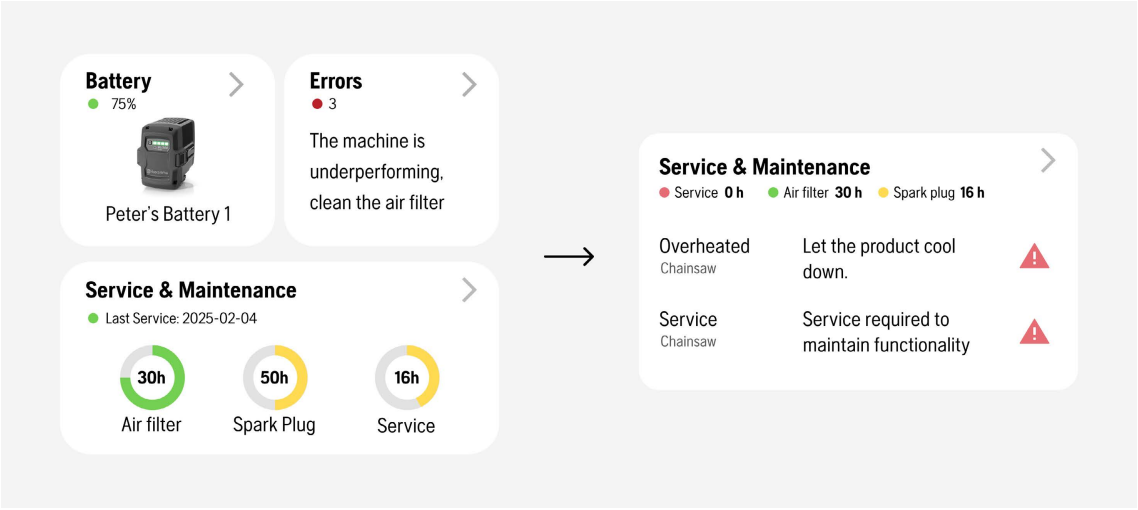


Figure 6.9: Changes in the Product details page among the widgets.

The equipment list selector on the dashboard page previously used radio buttons. After discussions during the design critique, it was changed to check boxes, allowing the user to have multiple equipment lists active instead of just one. This is because the user might bring multiple sets of equipment to a job or have another planned job immediately after. Another change made on the Dashboard was the Battery Overview. As shown in Figure 6.10, it was restructured vertically instead of horizontally, allowing the widget to contain more than three batteries.

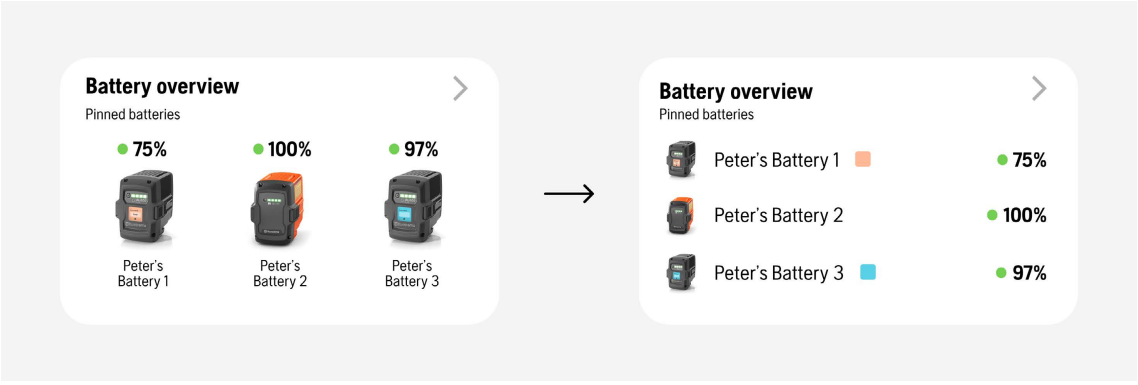


Figure 6.10: Changes in the Battery Overview widget on the Dashboard page.

On the spare parts page, a tab for consumables was added, with the intention to gather parts that often have to be changed, such as chains. With that in mind, it was placed as the first tab on the page, since it is reasonable to assume that it would be the most regularly visited.

## 6.4 Deliver

This section explains the process and execution of the end-user, and product specialist testing together with changes made in the third iteration of the prototype.

### 6.4.1 End-user testing

Conducting the end-user tests began with inviting the interviewees who participated in the in-person interviews to also participate in an end-user test. Each test were in the form of a cooperative evaluation, lasted for about 45 minutes and was structured around a series of tasks, which were to be executed by using the interactive prototype on a mobile phone. The tasks were divided into four groups: Products, Position, Profile, and Dashboard, one for each tab on the navigation bar in the prototype. The tasks could be to find a certain feature or page, or to add information. Every task had related follow-up questions such as "What information is this page providing?", "Is this information useful?", "Would you have used this function?", to get insights about how well the intention of the functionality was achieved. The test guide i shown in its entirety in Appendix F.

During the test, participants expressed that the position page and its features, with additional reminder options, is important and the most wanted feature within the app. The participants appreciated notifications, but said that it is important to decide by themselves what reminders they want and possibly if they can decide what time of the day they get reminders of things such as charging. The service page was addressed to have good information, but some participants were uncertain if they would manually add service tasks in a long-term perspective. However, all participants appreciated the spare part details page and thought it would simplify their work days when that functionality was easily accessible. The participants thought that the battery label solution fulfills the user need of being able to separate the batteries among each other. The equipment list was appreciated by the majority of the participants, but there were some thoughts about being able to manually check off things on the list before work. Further, some participants stated that they usually bring all their equipment every day and would not have any value in the solution, while some participants explained that they have a lot of variation in job tasks and would therefore have value in this solution. There was a wish from some participants to be able to see the products of colleagues in the app, as well as be able to connect the user account with other small companies if they often work together. Machine data was considered useful and interesting to have. One participant expressed a wish to see what cutting equipment is actually mounted on each saw in the app to make it easier to know what to buy when new equipment is needed. The dashboard was appreciated, mainly because of the possibility of editing it to make it more personalized. It was important for the participants that they can trust the system, that the data is updated and that the information is accurate, otherwise they thought that they probably would stop using the app.

The user requirement specification was ranked with the MoSCoW method, where the most important themes were ranked as must-haves. To confirm if the must haves

were still the most important, the participants were asked about the features that were created to fulfill these requirements, as well as features based on lower rankings. The following features based on both must-haves and should-haves were stated as the most valuable by the end-users:

- Real-time position tracking of products
- Reminders when forgetting products or losing products
- Theft prevention
- Identification and purchasing of spare parts
- Display of exact battery level and battery health status
- Separation of batteries

After all tasks, the participants were asked to answer the SUS-questionnaire, shown in 4.5.2. This revealed that the average SUS score was 90,625 out of 100, indicating that the usability of the system is clearly above an average system, according to the study of Sauro [84] mentioned in 4.5.2, and suggests that the usability of the designed user interface is good. The result indicates that the structure, layout, and general design do not need as much refinement as some of the functions mentioned during the test. Shown in Table 6.1 is the responses and score from all participants.

Table 6.1: SUS scores from the end-user testing

| *Partipant* | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | **Score** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 4 | 4 | 1 | 5 | 4 | 5 | 1 | 4 | 1 | **80** |
| 2 | 4 | 2 | 5 | 1 | 4 | 1 | 5 | 1 | 5 | 1 | **92.5** |
| 3 | 5 | 1 | 5 | 1 | 5 | 1 | 5 | 1 | 5 | 1 | **100** |
| 4 | 5 | 1 | 5 | 1 | 3 | 1 | 5 | 1 | 3 | 1 | **90** |
| *Average* | | | | | | | | | | | **90.625** |

Finally, the participants were asked a set of general questions, focusing on extracting the general thoughts and impressions of the prototype from each participant. All participants thought that they would use the app regularly and that it would make their job days easier. The participants said that they felt the app was well suited for their professions.

### 6.4.2 Product specialist testing

The product specialist testing was conducted, also in the form of cooperative evaluation, with five employees at Husqvarna Group, specialized in handheld products, containing relevant knowledge of the features and use of Husqvarna Fleet Services™. The test was based on the same guide as for the end-user testing and took about 45 minutes per person.

During the tests, it appeared that the dashboard was appreciated due to the possibility to edit and personalize. The last active products widget on the dashboard on the other hand seemed unnecessary for some of the participants. The equipment list was unclear to some of the participants because they felt they were directed to an edit mode of the lists. On the product page for the machines, the lock/unlock button appeared to be confusing and it was not clear to the majority of participants what the functionality of it was. On the machine data page, some participants said that it was hard to understand what the high, optimal and low intervals were. The service page was appreciated because it gathers all service related things that a user could need in one place. Some additional comments about service were the importance of being able to solve the errors in the app and that the app could provide a maintenance schedule. Further, all participants thought the spare parts page fulfilled the user need of easily finding spare parts. The concept of having colored labels for batteries was valued by the participants, but with one comment about that the serial number of the battery should be visible on the page to not mix up the physical batteries while labeling in the app. The precise health of the batteries on the battery page seemed unnecessary, and some participants believed that it could mislead users. The participants were positive about the position feature and the possibility of receiving notifications when forgetting equipment.

The test also included a SUS-questionnaire that was answered at the end of the session. The average SUS score was 80.5 which indicates that the usability of the system is above average, and therefore suggests that the prototype has good usability. The answers and scores from the participants are shown in Table 6.2.

Table 6.2: SUS scores from the product specialist testing

| *Partipant* | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | **Score** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 4 | 4 | 1 | 4 | 3 | 5 | 2 | 4 | 1 | **72.5** |
| 2 | 4 | 2 | 5 | 1 | 4 | 1 | 5 | 1 | 5 | 1 | **77.5** |
| 3 | 4 | 3 | 4 | 2 | 4 | 2 | 4 | 2 | 3 | 2 | **70** |
| 4 | 4 | 2 | 5 | 2 | 4 | 1 | 5 | 1 | 4 | 1 | **87.5** |
| 5 | 5 | 2 | 4 | 1 | 5 | 1 | 5 | 1 | 5 | 1 | **95** |
| *Average* | | | | | | | | | | | **80.5** |

### 6.4.3 Prototype - Third iteration

The third iteration based on the feedback from the user testing entitled a series of changes, mostly minor ones such as clarifying certain features. On the dashboard page, the active products widget was removed as a default widget and instead placed among the addable widgets when editing the dashboard. The use case for it was discovered to be unclear and only a few participants saw a potential use of it. One of the biggest changes was adding a checklist feature for the equipment lists, meaning the user could check off products before going out in field, or when packing up for the day as it were discovered to increase the value of that feature.

Another rather big addition was that the former locked/unlocked button was changed to block/unblock, instead functioning like blocking a credit card. The intention is to be used less frequently, in particular for when losing a product or in case of theft. This would avoid the products relying on an app connection with a more frequently used lock/unlock feature, that potentially could be a moment of irritation. To highlight the seriousness of blocking a product a page for blocking products was created, in which the user would need to insert a pin code making it more secure, together with giving the user a caution reminder informing the user of the consequences of blocking a product.

In the product's page, another variant of the add sensor button was created to replace it when all possible sensor are added. It would then just say sensors, informing the user that sensors can be managed by pressing that button. Additionally, a feature of manually adding the current cutting equipment of products, such as the guide bar and the chain was added. It was found to simplify the process of buying consumables, when not having access to the physical product.

For batteries, as shown in Figure 6.11, the status & health widget was changed. Firstly, the time estimation was changed to the date of the first use, since the battery time is very dependent on what product is being used, thereby an unreliable estimation. Furthermore, the age of batteries was found to be an interesting fact for the users and was therefore more relevant here. Additionally, the former charge capacity radial progress bar was changed to be named battery health, as it was considered to be more descriptive of the actual function. The exact percentage was changed for the statuses; bad, okay, and good, since it might be too revealing to provide the exact percentage to the user. It was also discovered that when adding a label to a battery, it is relevant to see some type of identification of the specific battery. Therefore, the serial number was added, making it possible to add a label to a battery, ensuring that it is the same product that is in front of them, as it is a risk of mixing batteries since they might be of the same or a very similar model.

Finally, on the service & maintenance page, the possibility of accessing the maintenance schedule was added to encourage the user to do regular maintenance on their products, and since it can be helpful to look at in case of errors.

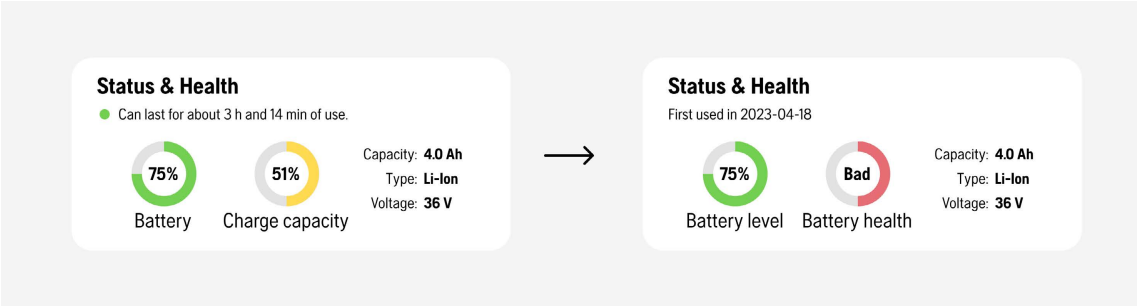


Figure 6.11: Changes in the Battery Status & Health widget on the Products page for batteries.

# 7

# Results

The results of this study consist of two deliverables. Firstly, the user requirement specification clearly defining the needs of arborists and loggers in a mobile application. Secondly, the prototyped interactive user interface in which features are added and the existing user interface is redesigned to fulfill these requirements.

## 7.1 User Requirement Specification

The final user requirement specification consists of 54 requirements divided into 15 groups based on the needs statements presented in 6.2.2. These are referred for example as *R1 Connectivity*, containing a bunch of related requirements that are referred to as *R1.1* and *R1.2* etc. The user requirements specification, together with an explanation of its structure, is presented below and in table 7.1.

Ten of the user requirements were arborist specific, including requirements related to battery, climbing gear, customer communication, and tree height measuring. Only two logger specific user requirements were identified which regarded log sales. The other 42 requirements were identified as relevant for both user groups. Four of the requirements were added after the user tests, as new needs and wishes appeared, and these were considered important to be able to meet the user needs.

The type of requirement was set as either functional or non-functional in the user requirement specification and each requirement was ranked using the MoSCoW method. The method was used to decide which requirements that the application must have, should have, could have, or won't have. There were no requirements that were ranked as won't have. Most of the requirements are ranked as should have, and a few are ranked as could have. The requirements ranked as must have were decided based on the largest clusters from the KJ analysis and what the user expressed as most important. The must have requirements were prioritized during ideation and prototyping, even though requirements ranked as should have also were implemented into the ideation and the prototype. The final prototype presented in the following section 7.2 is considered to fulfill 30 of the user requirements, while the existing Husqvarna Fleet Services™ is considered to fulfill 11 of them.

The user requirement specification follows the structure of a five column table with the following column headers:

1. **Reference** - giving each requirement a specific identification to simplify working with and referring to the requirements. The references follow the structure of "RX.Y", where the R is indicating that it is a requirement, followed by the number X representing the requirement group, and the number Y to represent the specific requirement within the group. For example, R1.1 referred to the first requirement related to Connectivity.
2. **User** - clarifying if the requirements is for arborists (A), loggers (L), or a common requirement among both of the user groups (A & L).
3. **Requirement** - the user requirement itself.
4. **Type** - specifying whether the requirements is functional (F) or non-functional (NF), in other words, if the requirement describes what the system should do or how the system should do it.
5. **Rank** - prioritizing requirements, using the MoSCoW method, both to simplify the ideation phase and to know Husqvarna Group for future work within the area. Thereby each requirement either received a rank of Must Have, Should Have, Could Have or Won't Have.
6. **Fulfilled** - specifying if the requirements are considered to be fulfilled (X) by the final prototype.
7. **Marked in gray** - specifying the requirements added later in the process.

Table 7.1: User Requirement Specification

| Ref. | User | Requirement | Type | Rank | Fulfilled |
|---|---|---|---|---|---|
| **R1** | | **Connectivity** | | | |
| R1.1 | A & L | the machine's functionality must not rely on the application or its connection | NF | Must | X |
| R1.2 | A & L | the user must have information accessible in the field | NF | Must | |
| R1.3 | A & L | the machine sensor should be built-in the machine | F | Should | |
| **R2** | | **Machine Data** | | | |
| R2.1 | A & L | the application must provide machine hours of each machine | F | Must | X |
| R2.2 | A & L | the application should provide the fuel consumption of each machine | F | Should | |
| R2.3 | A & L | the application should communicate the vibration levels | F | Should | |
| R2.4 | A & L | the application should communicate the lifetime of the spark plug | F | Should | X |
| R2.5 | A & L | the application should communicate the lifetime of the fuel filter | F | Should | |
| R2.6 | A & L | the application should alert the user when the air filter is dirty | F | Should | X |
| R2.7 | A & L | the application should alert if the product is overheated | F | Should | X |
| R2.8 | A & L | the application should communicate the cutting equipment attached to the saw | F | Should | X |

| Ref. | User | Requirement | Type | Rank | Fulfilled |
|---|---|---|---|---|---|
| **R3** | | **Machine Position** | | | |
| R3.1 | A & L | the application must track the position of the machines in real-time independently of the connection to the owners mobile or getaway | F | Must | X |
| R3.2 | A & L | the application must alert the user if any equipment is forgotten on the way to or from field | F | Must | X |
| **R4** | | **Planning** | | | |
| R4.1 | A & L | the application could help the user to estimate the duration and price of a job | F | Could | |
| **R5** | | **Preparations** | | | |
| R5.1 | A & L | the application should encourage and help preparation of the equipment before work | F | Should | X |
| **R6** | | **Protection & Theft Avoidance** | | | |
| R6.1 | A & L | it should be possible to block and unblock the products wihtin the application of the product itself | F | Should | X |
| R6.2 | A & L | the application should reduce the theft risk of the products | F | Should | X |
| **R7** | | **Risks & Hazards** | | | |
| R7.1 | A & L | the application should help the user to take enough breaks to be able to execute the work safely | F | Should | X |
| R7.2 | A & L | the application could help locating the users in emergency situations | F | Could | |
| R7.3 | A & L | the user could be able to digitally make a risk assesment | F | Could | |

| Ref. | User | Requirement | Type | Rank | Fulfilled |
|---|---|---|---|---|---|
| **R8** | | **Service & Maintenance** | | | |
| R8.1 | A & L | the application must provide the last service date of the product | F | Must | X |
| R8.2 | A & L | the application must log all service activities of each product | F | Must | X |
| R8.3 | A & L | the application must encourage and help the user to make consistent service of the products | F | Must | X |
| R8.4 | A & L | the application must notify the user when and before the product needs service | F | Must | X |
| R8.5 | A & L | the application should alert the user if a product is not working properly | F | Should | X |
| R8.6 | A & L | the application should recommend frequently bought things and where the closest retailer is located | F | Should | |
| R8.7 | A & L | The application could alert the user before upcoming breakdowns | F | Could | |
| R8.8 | A & L | The user could be able to solve errors within the application | F | Could | X |
| R8.9 | A & L | The application could provide maintenance schedules | F | Could | X |

| R9 | | **Spare Parts** | | | |
|---|---|---|---|---|---|
| R9.1 | A & L | the user must be able to identify the spare parts needed in the application | F | Must | X |
| R9.2 | A & L | the user should be able to identify the right chain in the application | F | Should | |

| Ref. | User | Requirement | Type | Rank | Fulfilled |
|---|---|---|---|---|---|
| **R10** | | **Usability & User Value** | | | |
| R10.1 | A & L | the application must be user friendly | F | Must | X |
| R10.2 | A & L | the moments of irritation within the application should be reduced | NF | Should | X |
| R10.3 | A & L | the application should be easy to start using for the first time | NF | Should | X |
| R10.4 | A & L | the application should be as simple as possible | NF | Should | X |
| R10.5 | A & L | the application should be easy to enter everytime it is used | NF | Should | |
| R10.6 | A & L | the application should allow assigning roles to employees | F | Should | X |
| R10.7 | A & L | the application should be valuable for small and large businesses | NF | Should | |
| R10.8 | A & L | the application should allow for personalization | F | Should | X |
| R10.9 | A & L | the application should gather as much of the functions as possbile in one application | F | Should | |
| R10.10 | A & L | the application could gather all products used during the workday | F | Could | |
| R10.11 | A & L | the application could notify the user about new products, updates and campaigns | F | Could | |

| Ref. | User | Requirement | Type | Rank | Fulfilled |
|---|---|---|---|---|---|
| **R11** | | **Battery & Charging** | | | |
| R11.1 | A | the application or the battery must display the exact battery level | F | Must | X |
| R11.2 | A | the application or the battery must display wether it is charged or uncharged | F | Must | X |
| R11.3 | A | the application or the battery should encourage the user to have charged batteries for the workday | F | Should | X |
| R11.4 | A | the application or the battery should state the battery owner | F | Should | X |
| R11.5 | A | the batteries should be in operable temperatures at all time | NF | Should | |
| **R12** | | **Climbing Gear** | | | |
| R12.1 | A | it should be possible to keep track of the inspection of the climbing gear in the application | F | Should | |
| R12.2 | A | the application could be compatible with personalized climbing gear | F | Could | |
| R12.3 | A | the application could allow personalization of the climbing gear | F | Could | |
| **R13** | | **Customer Communication** | | | |
| R13.1 | A | the application could help communicating the expected results to the customer | F | Could | |
| **R14** | | **Tree Height Measuring** | | | |
| R14.1 | A | the application could enable the user to measure tree height | F | Could | |
| **R15** | | **Log Sales** | | | |
| R15.1 | L | the application could provide price lists for different wood types | F | Could | |
| R15.2 | L | the application could enable the user to measure log length | F | Could | |

## 7.2 Final Design

The final design featured a user interface with four main tabs in the navigation bar, forming the structure of the presented below. Using the prototype mode in Figma, the prototype was created to be interactive, thus it is possible to open the prototype on a mobile device to the best extent replicate an actual mobile user interface, which was especially useful for user testing purposes.

### 7.2.1 Dashboard

The dashboard, shown in Figure 7.1, is intended to include the most important information that the user wants to access quickly, such as the battery level and products in need of urgent service. Specific batteries can be pinned to the widget, but when pressing the widget, the status of all batteries is available. Furthermore, it gives a hint about the battery label color, which is further explained in section 7.2.2. The status of when the data in the application were last updated is presented in the top of the interface, informing the user about the relevance of the data in the app. The intention is to potentially avoid disappointment of the data not corresponding to the reality because of the update frequency. From the dashboard the active equipment list can easily be changed, a deeper explanation on that feature is presented in the following section. The edit pen in the top right corner, allows the user to personalize the dashboard to their role or profession, fulfilling *R10.8*. The user can rearrange the order of the widgets, remove, edit and even add others that might be more relevant to them.

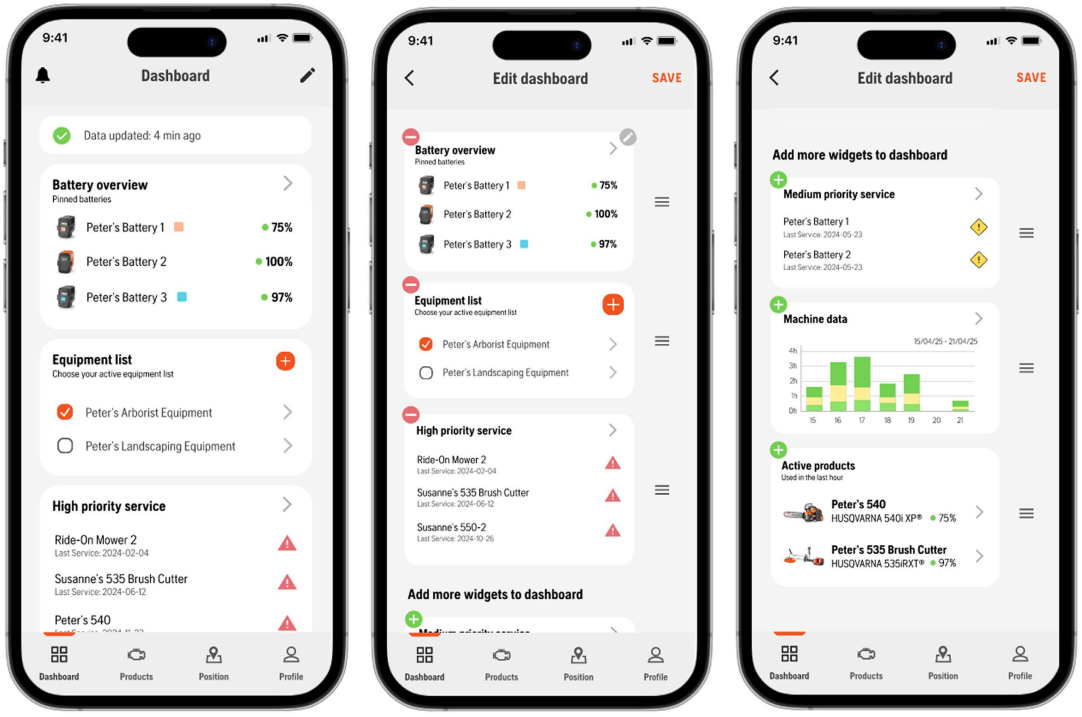


Figure 7.1: Dashboard in the final design.

### Equipment Lists

Accessible from the dashboard is the equipment lists, apart from selecting the active ones on the dashboard widget, the user can also move further in to the equipment list page. The first page, shown to the left in Figure 7.2, contains all the equipment lists created, together with a button for creating new lists. Located at the top of the page is an informational toast notification explaining the feature of equipment list to the users. Pressing a list on this page directs the user to the check off page, in which the users can control that all equipment within that specific list is packed, prepared and charged, fulfilling *R11.3* and *R5.1*. Lastly, the user can also edit a list, shown to the right in Figure 7.2. This page has the same layout as when creating a new equipment list, allowing the user to add a list name, set reminders for products in this specific list, preventing the users from forgetting or losing their equipment. Finally, the user can select the products to be included in that specific list.

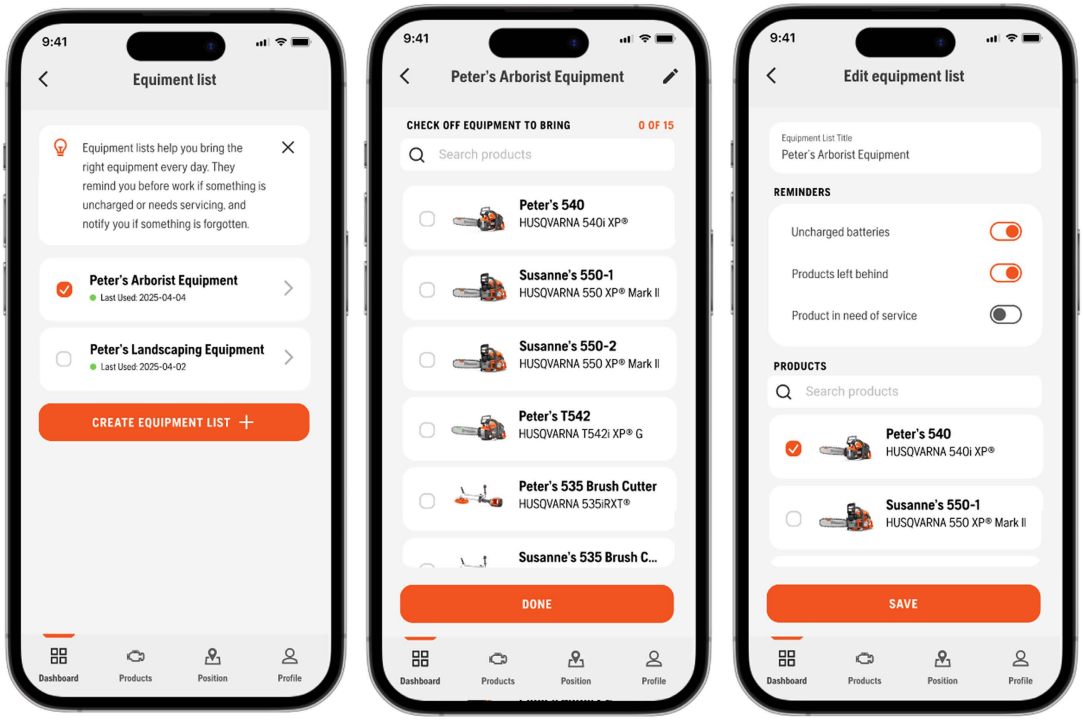


Figure 7.2: Equipment list in the final design.

### 7.2.2 Products

The second navigation item features all products in the fleet. Shown in Figure 7.3 the user initially faces a product list. From this page, the user has the possibility to sort the products from a bunch of orders, such as when first/last added, alphabetically, service priority, and last used. Additionally, the user can filter the products among handheld products, batteries, lawn mowers, and accessories. Finally, the user can find specific products easily by searching for the given nickname, product name, or product type. In the bottom, a primary button gives the user the possibility to add new products in their product fleet.

The list cards, showing all products together with brief information about the products, includes an image of the product for the user to easily distinguish the product type. Additionally, it includes the nickname of the product given by the user to distinguish several products of the same type, and the official product name. List cards for batteries also contain the exact current battery level, fulfilling *R11.1* and *R11.2*, quickly providing one of the most crucial information for the users to find easily. In case the product obtains some kind of service or error alert, it is illustrated with either a red warning icon for high-priority alerts, and a yellow caution icon for medium-priority alerts. The list cards provides visual structure, since all cards containing similar information are aligned in a vertical grid.

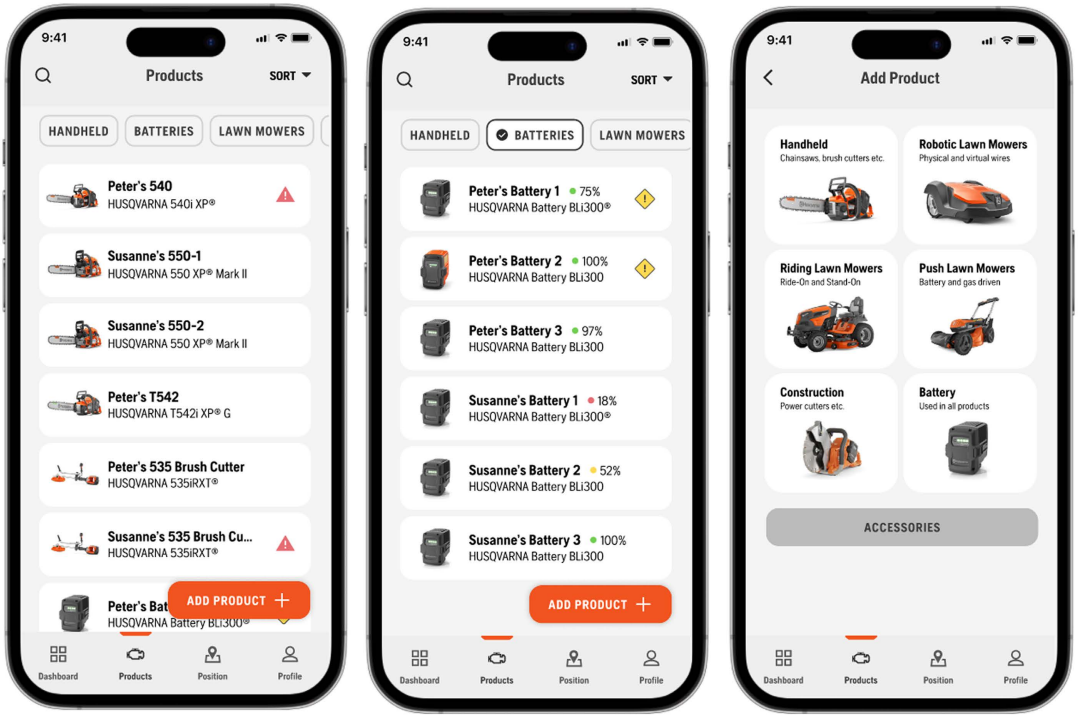


Figure 7.3: Products page in the final design.

### Machine details

When a product is selected in the list the user arrives on the product details page, shown in Figure 7.4. From this page the user can access all functions related to that specific product. At the top, there is a static area with a white background containing the nickname, official product name and a product image. In the top right there is an indication of the connection status of the product, followed by the connected sensors. Further down there is a sensor button, which can either be in the state of, add sensors, or if possible sensors are already added it will just say sensors. When pressing the button the user would either get the option to add a sensor to the product or manage the already installed sensors. By using an orange button it is possible to draw the attention of the user to the important event of managing sensors, in which the user is able to use the application with full functionality. Finally, the static area contains a block-button, giving the user the opportunity to disable the product from being able to use, fulfilling the user requirements *R1.1* and *R6.1*. If the block-button is pressed, the user arrives to another page where they have the option to block the product from use by inserting a pass code. It should work more or less like blocking a credit card. If the user wants to unblock a blocked product it is required to bring the product to a certified service center showing credentials of ownership and using the pin code again.

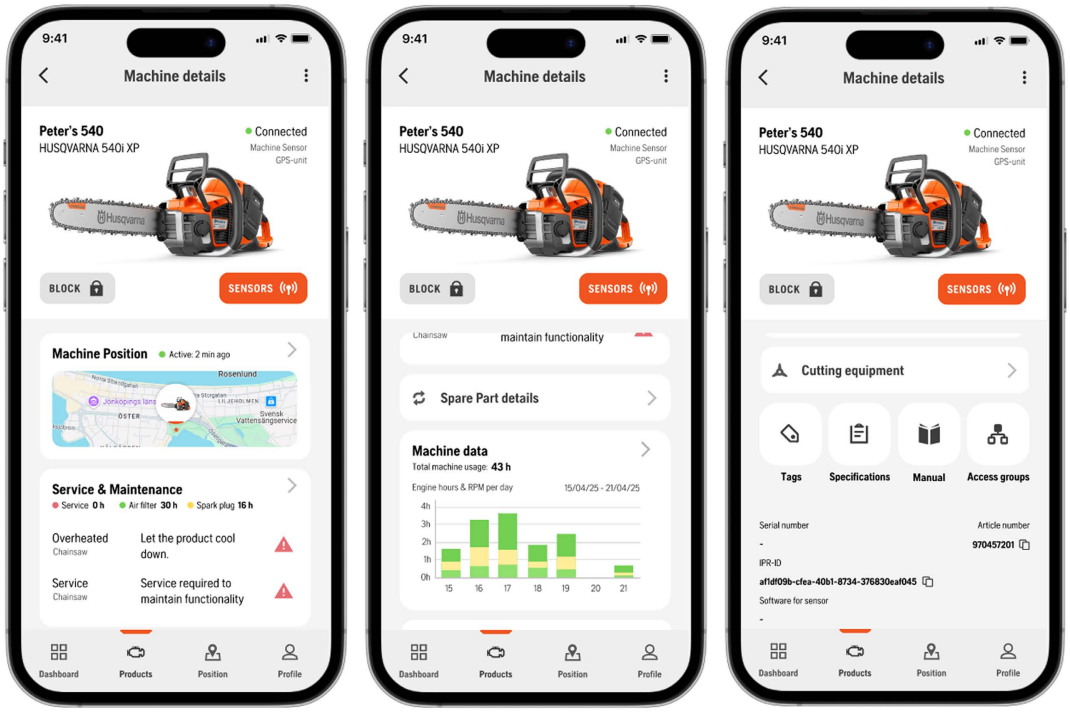


Figure 7.4: Machine details page in the final design.

The scrollable section with a light gray background is filled with related widgets. These briefly display information such as machine position, service & maintenance, machine data, spare part details, and other relevant information related to the product. When pressing a widget, which is signaled by using arrows on each widget, the user is directed to the specific page of that function, providing deeper information than the widget. Thus, an explanation of the feature of these widgets is covered when describing each specific page further down.

### Battery details

In the top static area of battery, the sensor button is replaced with an add label button, shown in Figure 7.6. This feature was added to meet the need of separating batteries from each other, thus fulfilling *R11.4*. The concept is based on Husqvarna Group including a set of battery labels in six colors in the package of a battery, providing the user with a convenient and coherent way to distinguish their batteries, which is shown in Figure 7.5.

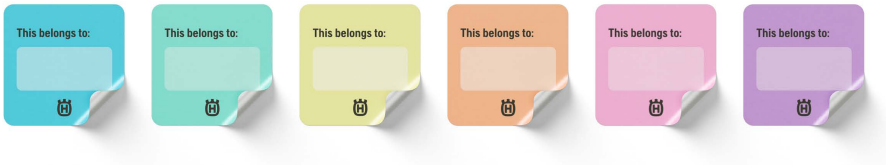


Figure 7.5: Battery labels in the different colors.

To fully make the experience seamless between the application and the physical product there is a function to add a label in the application. This would allow the user to replicate the physical label, making it easier to manage the batteries within the application. Thus, pressing the button takes the user to the battery label page, in which they can create a label to be placed on the digital battery, by selecting the text and color of the label. Finally, in the top right corner the serial number of the product is provided for the user to easily be able to know what battery they are creating the label for.

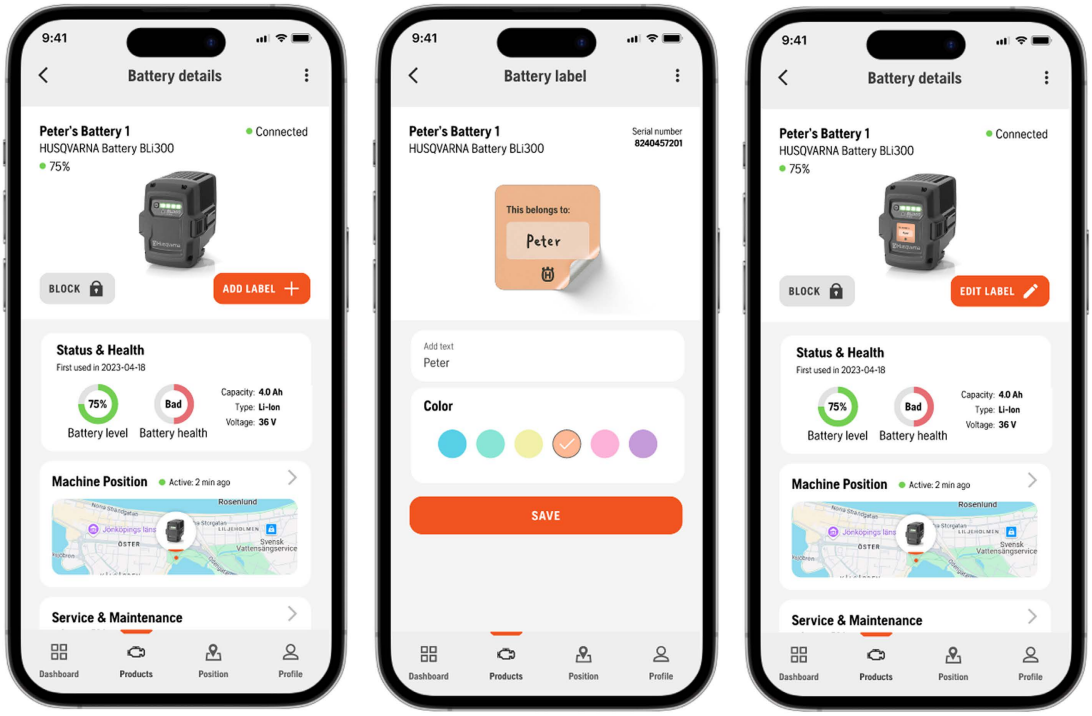


Figure 7.6: Battery label concept in the final design.

### Service & Maintenance

In the service & maintenance page the user is introduced to three maintenance countdowns based on runtime, these vary depending on the product type and power source. Shown in Figure 7.7, the electric chainsaw features maintenance countdowns until a recommendation for a complete service, a cleaning and air filter exchange encouraging the user to manage the product optimally, fulfilling *R2.4*, *R2.6*, *R8.3* and *R8.5*. In addition, the last service date is stated, fulfilling *R8.1*. Following this, is a button leading into the spare part details page which is presented further down in the chapter. The errors widget informs the user about current errors with the product, as well as the proposed fix. In case of an error, the application will send the user a notification, fulfilling *R2.7* and *R8.4*. The manual is linked for easy access in troubled situations. Underneath, the service logs are gathered, where new service events can be added by pressing the big orange button at the bottom, which draws attention to the important action of performing consistent services, fulfilling *R8.2*. In that page, shown to the right in Figure 7.7, service and maintenance activities can be used in an identical way as the existing solution was considered to fulfill its purpose. Finally, at the bottom of the page the maintenance schedule is available.

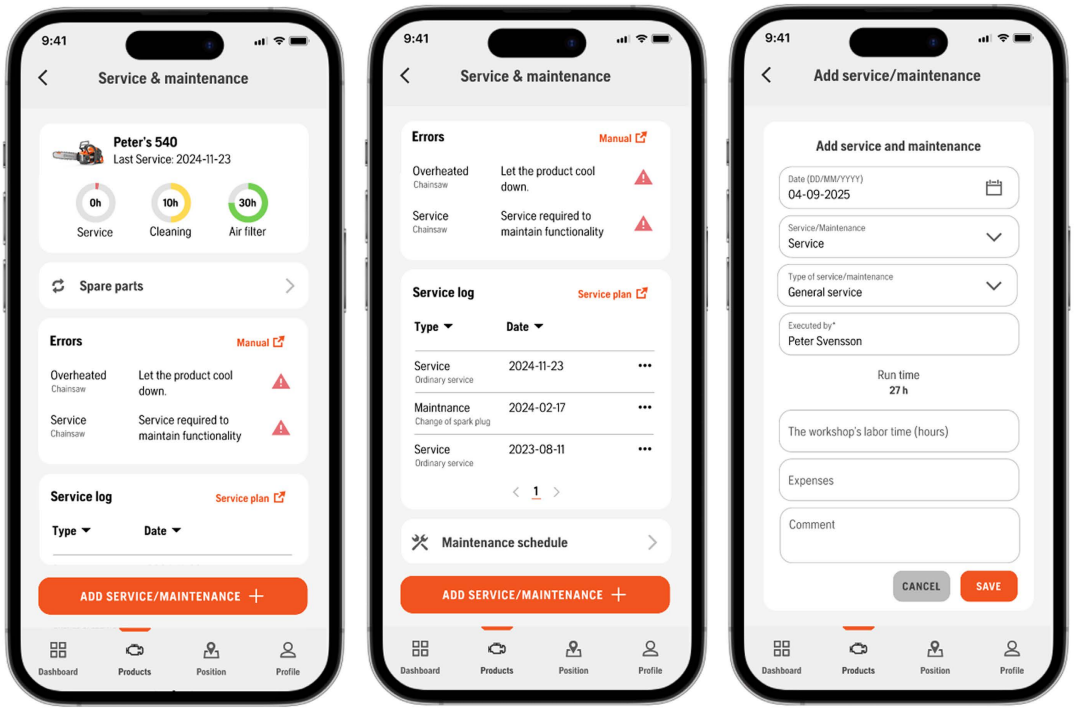


Figure 7.7: Service & maintenance in the final design.

### Spare Part details

The spare parts page, shown in Figure 7.8, fulfilling *R9.1*, features a scrollable list of spare part cards, including the official part name, the article number and a purchase button, directing the user to the product's page in the web shop of Husqvarna. In the top right corner the manual is linked in case the user seeks for additional information. The page is divided into several tabs containing groups of spare parts, aligning with the manuals. When an exploded view is available it is placed as a zoomable background helping the user in finding the right part.

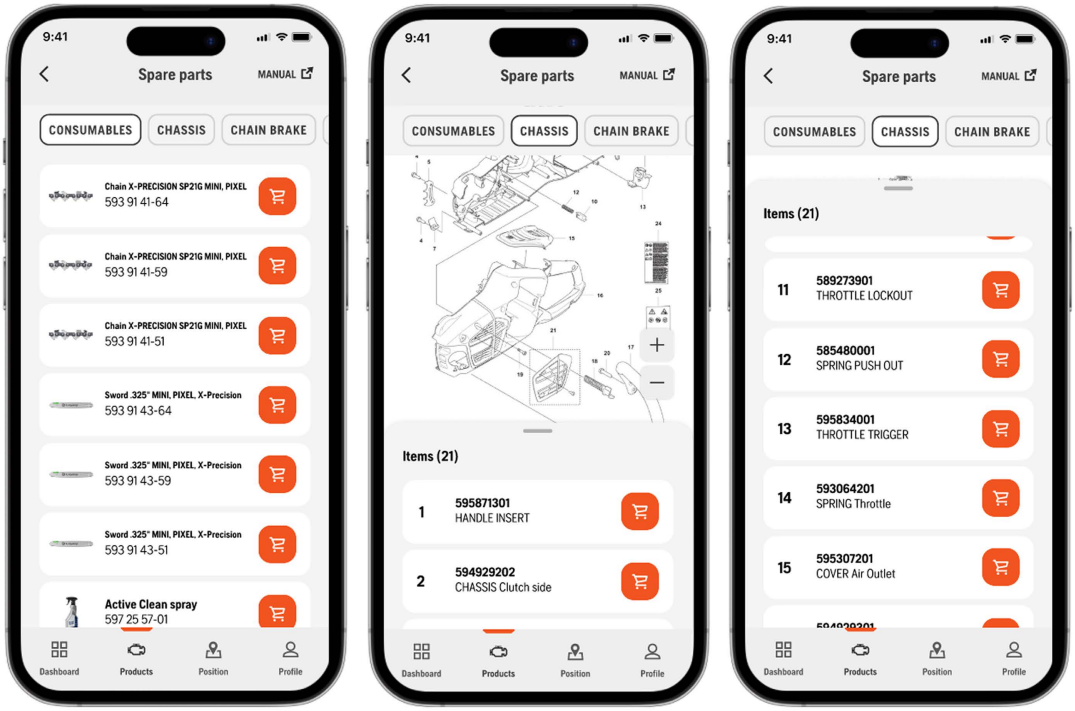


Figure 7.8: Spare parts page in the final design.

### Machine Data

The machine data page features several applications of machine usage in hours, fulfilling *R2.1*. It is divided in the following two parts, total machine usage and detailed machine data. Whereas, the latest includes total machine usage per week and daily average. Lastly it also includes an operation log, where operation activities are logged.

### 7.2.3 Position

The position tab includes all information about the real-time GPS position of the products within the fleet, fulfilling *R3.1*. The user is introduced with a panable and zoomable map showing the location of each product, and if several products are located at the same place they are grouped together, with an indication in the top right of total products at that location. In the list the user can scroll trough all products, and for efficiency reasons there is a possibility to search for specific products. When selecting a product on the map, the user gets zoomed in to the location of that specific product on the map. The list is then changed to product position information, including address, coordinates, and directions. The block button is also placed here to be available in emergency situations, such as product theft. Finally, there is a button at the bottom indicating if there are any active reminders for when leaving the product behind. When that button is pressed the user is directed to reminder settings, shown to the right in Figure 7.9. In this page the user can set exceptions to the notifications, such as home and work as well as decide the range of distance in which the reminders will be sent. The reminders were added to fulfill, *R3.2* and *R6.2*, by reminding the user that products are forgotten when being further away from the product than the set limit. Thus, it prevent forgetting products when heading to the the field, forgetting products in the field, and notifying if the products are stolen or moved to odd locations.

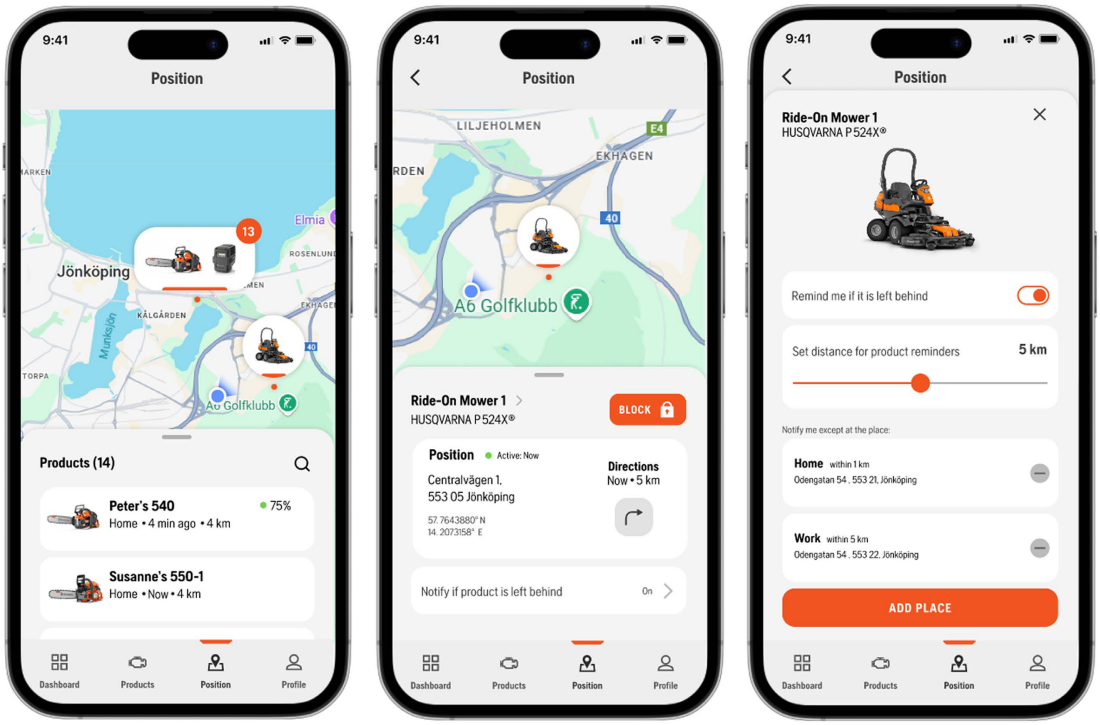


Figure 7.9: Position page in the final design.

### 7.2.4 Profile

The profile page, shown in Figure 7.10, contains user details, including name, role, and picture. Following this, is a team widget, showcasing the team member and their roles. The roles control the access groups to certain products, for example the team leader could have access to all products of their team members, fulfilling *R10.6*. Following is a widget containing the account settings page, legal page, news page, and the feedback page. Within the account settings, the user can manage notification options related to postilion, battery, service and for breaks. The break time alerts was added to fulfill *R7.1*, by reminding the users to take adequate breaks when working, with the intention of improving safety, since high focus is required to perform many of the tasks during their workday. Finally, the Profile also includes a log out button and information about the current version of the application.

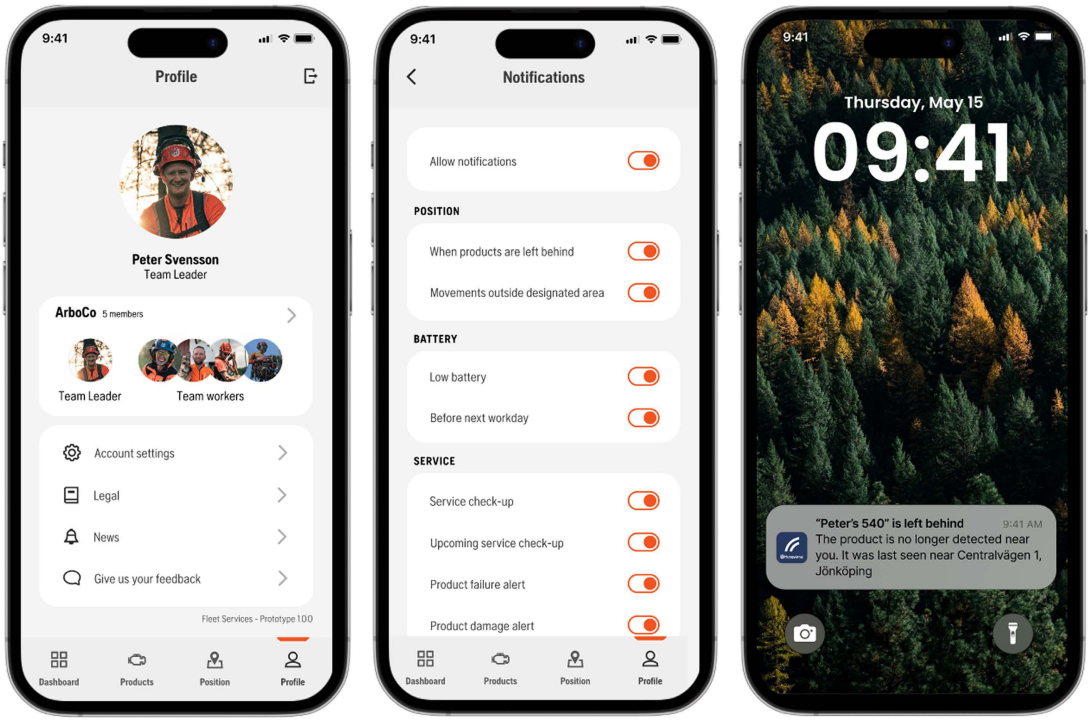


Figure 7.10: Profile page in the final design.

### 7.2.5 Design Theory in Practice

In the following section the usability, design system and accessibility of the proposed user interface is explained.

#### Usability

The usability of the application was tested with the system usability scale (SUS). The system was found to score high points from both end-users and product specialists at Husqvarna Group and therefore meets the requirement *R10.1*. The application signal what the user can do within each page by having informative headers and icons such as arrows and other indicators. By using contrasting colors, important events are highlighted. There is a visual hierarchy within the application due to the use of typography in different sizes, as well as visual structure by having grouped elements in a vertical grid. The app is designed to help the user find what they are looking for as easily as possible, without receiving unnecessary information. Therefore, the requirements *R10.2*, *R10.3* and *R10.4* are met.

#### Design System

The choice of color, typography, and general layout in the application is mainly based on the Husqvarna design system. By using the design system, the brand is clearly communicated, which contributes to increased trust between the company and its users. Apart from colors and typefaces used from the design system, components such as the navigation bar, buttons, and icons have been used to align the interface with other services by Husqvarna Group.

#### Accessibility

The WCAG guidelines are met at level AA throughout the entire application. This is achieved through the use of high-contrast colors, appropriately sized typography tailored to readability, and a design approach that prioritizes cognitive accessibility. Clear and concise language is employed to enhance understanding, while predictable navigation structures contribute to an intuitive user experience. The level AA is good enough to reach a broad accessibility and improved user experience.

# 8

# Discussion

In this chapter, the process and results are discussed. Factors that could have affected the outcome of this study are debated, including limitations on the final design and suggestions for future work.

## 8.1 Process and execution

This section discusses the process and execution of this study, including the prototyping and user testing.

### 8.1.1 Prototyping

As briefly mentioned in the methodology, high fidelity prototypes were developed in favor of the low fidelity prototypes. Several reasons contributed to that decision. The main reasoning is that Husqvarna Group already have a well developed design system with existing components for a big majority of the graphical elements used in the prototype. Thereby, creating additional low fidelity prototypes except for the ones generated during the Crazy 8's and the wireframes felt excessive. Especially since the ideated elements might conflict with the design system that was requested by Husqvarna Group, to be used in order to create something in line with the identity and thereby something that would be more useful for them. Although, it was not restricted to come up with new components complementing the design system as long as they align with the attributes of the design system, and in that sense more low fidelity prototyping could have furthered the process. Additionally, if creating the low fidelity prototypes there would have been relevance in testing them as well to generate insights. Unfortunately, the time was at this point of the process restricted and it was considered to be more valuable to proceed with the high fidelity prototyping utilizing the already created components, streamlining the process.

### 8.1.2 User testing

During the study in total nine in-person user tests were conducted, whereas four of these were actual end-users, and five were product specialists working at Husqvarna Group with expertise on handheld products. Several factors contribute to the fairly small number. Mainly, due to the geographical location of the available end-users.

Involving more end-users would mean traveling around seven hours, forth and back, while getting one, or if lucky two user tests. In other words, it was unreasonable to gather a larger sample considering the project's timeline.

Additionally, all four end-user tests were conducted solely with professional arborists. However, two end-users tests were scheduled with loggers, but due to sudden events they were impossible to carry out. Thus, feedback from loggers was absent, which would have been valuable for the study. On the other hand, all the user requirements that based the added features in the prototype were either common requirements for both arborists and loggers, or arborist specific. Meaning that there were no particular features based on the specific requirements for loggers, as described in 6.3.1.

Due to confidentiality, all participants in the interviews and observations, constituting the data collection, thereby the foundation of the user requirements, were all connected to Husqvarna Group in some way. The arborists and loggers had or currently were a part of their development team, meaning that they were provided with new products from the company in a development purpose, in exchange for valuable feedback of how the products perform in a real use case scenario. This could have affected the attitude towards a complementing mobile application and the study. Firstly, it is reasonable to assume that professionals that are a part of a development team, might have a positive attitude towards new technology and mobile applications. On the other hand, the participants tended to have a slightly cautious attitude towards applications created by Husqvarna Group, since they appeared to have disappointed them in the past. Secondly, it is also reasonable to assume that a member of the development team might have a strong technical knowledge, or at least interest, possibly stronger than the average arborist or logger, affecting the user requirements, especially in terms of service and maintenance related matters.

## 8.2 Limitations on the Final Design

The features within the final design, is at this time, not possible to implement with the current system of Husqvarna Fleet Services™. It is rather something to strive for, a representation of the user requirements and how they can be fulfilled. This of course limit the probability of this user interface becoming a reality, since it might require additional resources for Husqvarna Group. But this thesis was also about identifying how far the current system is from what is desired and what is valued by the users, making the final design a clear measure for Husqvarna Group on that.

### 8.2.1 Tree Professional focused

In this study the target group was tree professionals, although the service has a wider range of users, such as landscaping firms. This study is rather focused on professional arborist and loggers, working out in field, even though the service is also meant to be used by other roles at the company, such as managers and team leaders. The final design is thereby designed in the perspective of tree professionals, and how it would be best suited for them, utilizing the base of the existing interface.

The proposed user interface may be less valuable for the other target group and that is something to be considered and evaluated before implementing the added features. Changing existing features or the interface solely according to this study could potentially affect the experience for the primary users.

## 8.3 Ethical Consideration

Ethical considerations were discussed early in the process to acknowledge potential concerns, as highlighted in 1.4. During the data collection, which involved users, ethics were prioritized. The users were clearly informed about how the data would be collected, managed and stored according to GDPR. All participants were also required to sign a consent form to ensure that they knew the terms of the interviews and tests. This procedure resulted in the preservation of an ethical process.

### 8.3.1 Employee monitoring

Since the design solution involves real-time GPS tracking and detailed machine data of products, users have expressed ethical concerns about employee monitoring. Users saw a potential risk that managers could violate personal boundaries and use tracked data against employees. The managers interviewed in this study did not express that they would use the system for monitoring purposes. One explanation was that the work is already measurable in many ways. However, it was mentioned that the GPS tracking could be used to ensure that employees return home after a work day and do not suffer from a job injury in field. The system also allows tracking of machine data which can lead to monitoring of how efficient employees work in terms of machine usage. It could nevertheless contribute to a misrepresentation of someone's performance since all work related to tree professionals is not done by usage of machines. With the current design solution it is not possible to ensure that monitoring will not appear among users, therefore it would be ethical to address this potential risk to new users. In that way, it is up to the user to decide whether or not to use the system.

## 8.4 Future Work

This sections presents the suggested future work on this study, including user testing and investing potential solutions to make the features in the final design feasible in practice.

### 8.4.1 Further end-user testing

Future work would initially include end-user testing with loggers, getting their feedback and thoughts on the user interface design and its features. It would also include user testing with a bigger sample, including a more varied target group, giving a better understanding of how the proposed design meet the requirements for these professionals and organizations as well.

### 8.4.2 Investigating potential position tracking systems

In terms of making it possible for features to be integrated into the current application, further development is needed on the real-time GPS position tracking system, since the current system does not support that. Suggestively, by discovering how already existing GPS systems on Husqvarna Group's products can be applied on handheld products, or if external existing solutions could be utilized, such as Apple Air Tags, that was discovered to be used by participants to track their equipment.

### 8.4.3 Internal Fleet Machine Sensor

In the data collection it was found that having an externally mounted sensor on the products is not desired by the users. In terms of lowering the threshold for user adapting measuring devices such as the Fleet Machine Sensor, it is suggested that further work is done on whether it could be mounted within the products or be internally installed within all products from production.

### 8.4.4 Risk assessment

Arborists and loggers are required to perform a risk assessment before doing any work to recognize potential risks. During data collection and end-user tests, it was stated as a wish to be able to do the risk assessment in an app like Husqvarna Fleet Services™ to have it all gathered. For future work, it is therefore suggested to explore if already existing risk assessment systems could be applied to Husqvarna Fleet Services.

### 8.4.5 Climbing equipment

During data collection, an identified requirement for arborists was the management and inspection of climbing gear. Due to the already existing system Scannable, which was highly appreciated by the users, it was not prioritized in the development of the app. However, it could be investigated if it is possible to integrate Scannable or a similar solution within the app to allow arborists to gather their entire fleet of products.

### 8.4.6 Purchasing spare parts

The final design proposes an interface with purchasing buttons that link the user to the specific page of that part on the Husqvarna website, allowing the user to purchase spare parts there. We suggest that this process is evaluated even more since it may be able to improve. Purchasing parts directly in the app, instead of directing the user to the website, is one suggested area to explore. Another is that the workers have a wish list or order list that is available to the manager that then can make the purchase. Finally, the target group value a strong relationship with a physical dealer, thus it would be interesting to explore their role in the process, potentially some kind of click and collect service at a chosen dealer, to keep that valuable bond.

### 8.4.7 Reaching the target group

It was discovered that there is very little knowledge of Husqvarna Fleet Services™ among the target group. One reason could be that the current application is not adapted to them, thus the marketing is not reaching them. On the other hand, all participants in the study had a strong relationship with Husqvarna Group, potentially making them the most updated among the user group. However, it is suggested to explore how to inform the target group about the existence of the service.

# 9

# Conclusion

In conclusion, this master's thesis in collaboration with Husqvarna Group aimed to explore the specific user requirements of arborists and loggers in a mobile application designed to suit their workday. Guided by the research question (RQ):

> *What are the specific user requirements of arborists and loggers in a mobile user interface?*

As well as the following sub-research question (SQ):

> *Which valuable features can increase the adoption of a mobile user interface for arborists and loggers?*

The user requirements were systematically identified through data collection and subsequently refined through iterative user testing. These requirements are presented in their entirety in Table 7.1, providing a comprehensive foundation for designing a mobile solution that effectively supports the workday of the target group.

To understand how an user interface could be designed to fulfill the user requirements and what features were especially valued by the users, an ideation phase was initialized resulting in an interactive Figma prototype of a mobile user interface. The prototype was user tested and thereafter evaluated and improved. It resulted in a user interface design with a good measured perceived usability that the users considered to fulfill many of the user requirements.

Several user requirements were found to be particularly important for arborists and loggers in a mobile application. These requirements were ideated into features, tested by the users, and confirmed as bringing user value. To answer the SQ, a list including the most valued features that can increase adoption of a mobile user interface for arborists and loggers is presented below:

- Real-time position tracking of products
- Reminders when forgetting products or losing products
- Theft prevention
- Identification and purchasing of spare parts
- Display of exact battery level and battery health status
- Separation of batteries

# Bibliography


[1] P. S. Jacob Krantz, *Personal communication*, Meeting with Jacob Krantz and Patrik Sigurdh, Husqvarna Group, January 27, 2025, 2025.

[2] H. Group., *At a glance*, Accessed: 2025-02-19, n.d. [Online]. Available: https://www.husqvarnagroup.com/en/at-a-glance.

[3] European Union, *Data protection: Gdpr*, Accessed: 2025-02-03, 2025. [Online]. Available: https://europa.eu/youreurope/business/dealing-with-customers/data-protection/data-protection-gdpr/index_en.htm.

[4] C. McParland and R. Connolly, "Dataveillance in the workplace: Managing the impact of innovation," *Business Systems Research*, vol. 11, no. 1, pp. 106–124, 2020, Cited by: 20; All Open Access, Gold Open Access, Green Open Access. DOI: 10.2478/bsrj-2020-0008.

[5] W. W. A. Initiative, *Web content accessibility guidelines (wcag) overview*, Accessed: 2025-02-03, n.d. [Online]. Available: https://www.w3.org/WAI/standards-guidelines/wcag/#intro.

[6] H. Group, *The tree professionals target group*, Confidential internal document, not publicly available, n.d.

[7] L. A. Roman, H. Pearsall, T. S. Eisenman, *et al.*, "Human and biophysical legacies shape contemporary urban forests: A literature synthesis," *Urban Forestry & Urban Greening*, vol. 31, pp. 157–168, 2018, ISSN: 1618-8667. DOI: https://doi.org/10.1016/j.ufug.2018.03.004. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1618866717307665.

[8] D. Dujesiefken, C. Drenou, P. Oven, and H. Stobbe, *Arboricultural practices*. Springer, 2005, pp. 419–441, Cited by: 12. DOI: 10.1007/3-540-27684-X_16.

[9] E. Abramuszkinová Pavlíková, W. Robb, and J. ácha, "An ergonomic study of arborist work activities," *Heliyon*, vol. 10, no. 4, 2024, Cited by: 0; All Open Access, Gold Open Access, Green Open Access. DOI: 10.1016/j.heliyon.2024.e26264.

[10] J. Pihl, *Personal communication*, Interview with Johan Pihl, Arborist, February 21, 2025, 2025.

[11] H. A. Norberg, *Personal communication*, Meeting with Håkan A Norberg, Product Manager Fleet Services, Husqvarna Group, February 6, 2025, 2025.

[12] A. R. Rissman, E. Geisler, T. Gorby, and M. G. Rickenbach, "maxed out on efficiency: Logger perceptions of financial challenges facing timber operations," *Journal of Sustainable Forestry*, vol. 41, no. 2, pp. 115–133, 2022, Cited by: 2. DOI: 10.1080/10549811.2020.1841008.

[13] J. Rosecrance, E. Lagerstrom, and L. Murgia, "Job factors associated with occupational injuries and deaths in the united states forestry industry," *Chemical Engineering Transactions*, vol. 58, pp. 115–120, 2017, Cited by: 3. DOI: 10.3303/CET1758020.

[14] J. Joszczuk-Januszewska, "Importance of cloud-based maritime fleet management software," *Communications in Computer and Information Science*, vol. 395 CCIS, pp. 450–458, 2013, Cited by: 6. DOI: 10.1007/978-3-642-41647-7_55.

[15] S. Turrin and M.-Z. Ouertani, "Industrial fleet services: Introduction and application case," *Lecture Notes in Mechanical Engineering*, vol. PartF4, pp. 621–628, 2016, Cited by: 2. DOI: 10.1007/978-3-319-27064-7_62.

[16] Husqvarna, *Husqvarna fleet services overview*, YouTube video, Accessed: 28-Jan-2025, May 2019. [Online]. Available: https://www.youtube.com/watch?v=PWMBMLzjiLw.

[17] Husqvarna AB, *All about husqvarna fleet services*, Accessed: 2025-02-04, n.d. [Online]. Available: https://www.husqvarna.com/us/services/fleet-services/.

[18] Husqvarna, *Husqvarna fleet services operation manual*, Accessed: 2025-02-04. [Online]. Available: https://www.manualslib.com/manual/3308910/Husqvarna-Fleet-Services.html#manual.

[19] Husqvarna AB (publ). "Husqvarna fleet services maskinsensor." Accessed: 2025-02-04. (n.d.), [Online]. Available: https://www.husqvarna.com/se/fleet-services-utrustning/fleet-services-maskinsensor/#-.

[20] Husqvarna AB (publ). "Husqvarna maskinsensor fleet services." Accessed: 2025-02-04. (n.d.), [Online]. Available: https://www.husqvarna.com/se/fleet-services-utrustning/maskinsensor-fleet-services/#-.

[21] Husqvarna AB (publ), *Professional products and services 2025*, Copyright ľ 2025 Husqvarna AB (publ). All rights reserved. Husqvarna and other product and feature marks are trademarks of Husqvarna Group or its licensors. The Bluetoothő word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by Husqvarna is under license. Available at: https://www.husqvarna.com. Accessed: 28-Jan-2025., 2025.

[22] P. Bettinger, K. Merry, S. Fei, A. Weiskittel, and Z. Ma, "Usefulness and need for digital technology to assist forest management: Summary of findings from a survey of registered foresters," *Journal of Forestry*, vol. 121, no. 1, pp. 1–11, 2023, Cited by: 8. DOI: 10.1093/jofore/fvac028.

[23] H. Wever, M. Michels, and O. Musshoff, "From the axe to the app a descriptive analysis of the use of smartphones and tablets among german foresters; [von der axt zur app eine deskriptive analyse zur nutzung von smartphones und tablets unter deutschen forstwirten]," *Berichte uber Landwirtschaft*, vol. 101, no. 3, 2023, Cited by: 0. DOI: 10.12767/buel.v101i3.481.

[24] *Husqvarna connect*, https://www.husqvarna.com/se/tjanster/husqvarna-connect, Accessed: 2025-04-30, 2025.

[25] STIHL, *MY STIHL App - Funktioner och Fördelar*, Accessed 2025-02-11, 2025. [Online]. Available: https://www.stihl.se/sv/mystihl?utm_source=chatgpt.com.

[26] STIHL, *STIHL Connected - Digital Hantering av Din Maskinpark*, Accessed 2025-02-11, 2025. [Online]. Available: https://www.stihl.se/sv/proffs/digitalalosningar/stihl-connected?utm_source=chatgpt.com.

[27] Arboreal, *Arboreal Tree Height Advanced Tutorial*, Accessed 2025-02-11, 2025. [Online]. Available: https://www.youtube.com/watch?v=nQRxtd7Y4Dc.

[28] Arboreal, *New Release of Arboreal Forest Save Time and Navigate to Your Plot*, Accessed 2025-02-11, 2025. [Online]. Available: https://arboreal.se/en/blog/new-release-of-arboreal-forest-save-time-and-navigate-to-your-plot?utm_source=chatgpt.com.

[29] *Scannable*, https://www.scannable.io/industry/arboriculture, Accessed: 2025-04-30, 2025.

[30] R. Farrell and C. Hooker, "Design, science and wicked problems," *Design Studies*, vol. 34, no. 6, pp. 681–705, 2013, ISSN: 0142-694X. DOI: https://doi.org/10.1016/j.destud.2013.05.001. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0142694X13000471.

[31] H. W. Rittel and M. M. Webber, "Dilemmas in a general theory of planning," *Policy Sciences*, vol. 4, no. 2, pp. 155–169, 1973. DOI: 10.1007/BF01405730.

[32] C. Fabricatore, D. Gyaurov, and X. Lopez, "Rethinking serious games design in the age of covid-19: Setting the focus on wicked problems," in *Serious Games*, M. Ma, B. Fletcher, S. Göbel, J. Baalsrud Hauge, and T. Marsh, Eds., Cham: Springer International Publishing, 2020, pp. 243–259, ISBN: 978-3-030-61814-8.

[33] A. Ebert, N. D. Gershon, and G. C. van der Veer, "Human-computer interaction: Introduction and overview," *KI - Kunstliche Intelligenz*, vol. 26, no. 2, pp. 121–126, 2012, Cited by: 15. DOI: 10.1007/s13218-012-0174-7.

[34] J. Nielsen, *Usability 101: Introduction to Usability*, Jan. 2024. [Online]. Available: https://www.nngroup.com/articles/usability-101-introduction-to-usability/.

[35] P. W. Jordan, *An Introduction to Usability*. CRC Press, 2020. DOI: 10.1201/9781003062769. [Online]. Available: https://www.taylorfrancis.com/books/mono/10.1201/9781003062769/introduction-usability-patrick-jordan.

[36] E. J. Rose, C. M. MacDonald, and C. Putnam, "Teaching design systems: Towards a flexible and scalable model for the ux classroom," Cited by: 6; All Open Access, Bronze Open Access, 2022, pp. 107–113. DOI: 10.1145/3513130.3558985.

[37] J. Yew, G. Convertino, A. Hamilton, and E. Churchill, "Design systems: A community case study," Cited by: 5, 2020. DOI: 10.1145/3334480.3375204.

[38] Y. Lamine and J. Cheng, "Understanding and supporting the design systems practice," *Empirical Software Engineering*, vol. 27, no. 6, 2022, Cited by: 4; All Open Access, Green Open Access. DOI: 10.1007/s10664-022-10181-y.

[39] L. Moreno, P. Martínez, and B. Ruiz-Mezcua, "Integrating hci in a web accessibility engineering approach," *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 5616 LNCS, no. PART 3, pp. 745–754, 2009, Cited by: 2; All Open Access, Bronze Open Access. DOI: 10.1007/978-3-642-02713-0_79.

[40] World Health Organization, *Disability - world health organization*, Accessed: 2024-01-29, 2024. [Online]. Available: https://www.who.int/health-topics/disability#tab=tab_1.

[41] L. Guarino Reid and A. Snow-Weaver, "Wcag 2.0 for designers: Beyond screen readers and captions," *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 5616 LNCS, no. PART 3, pp. 674–682, 2009, Cited by: 7; All Open Access, Bronze Open Access, Green Open Access. DOI: 10.1007/978-3-642-02713-0_71.

[42] V. Luque Centeno, C. Delgado Kloos, J. Arias Fisteus, and L. Álvarez Álvarez, "Web accessibility evaluation tools: A survey and some improvements," *Electronic Notes in Theoretical Computer Science*, vol. 157, no. 2 SPEC. ISS. Pp. 87–100, 2006, Cited by: 19; All Open Access, Gold Open Access. DOI: 10.1016/j.entcs.2005.12.048.

[43] World Wide Web Consortium, *Wcag 2.0 aaa conformance*, Accessed: 2024-01-29, 2024. [Online]. Available: https://www.w3.org/WAI/WCAG2AAA-Conformance.

[44] A. Cooper, R. Reimann, D. Cronin, C. Noessel, J. Csizmadi, and D. LeMoine, *About Face: The Essentials of Interaction Design 4th Edition*. Wiley, 2014, ISBN: 9781118766583.

[45] M. Chen, G. Fadel, C. Xue, H. Wang, I. Mata, and Y. Chen, "Evaluating the cognitive process of color affordance and attractiveness based on the erp," *International Journal on Interactive Design and Manufacturing*, vol. 11, no. 3, pp. 471–479, 2017, Cited by: 10. DOI: 10.1007/s12008-015-0286-z.

[46] S.-E. Pakr, "Research of color affordance concept and applying to design," *Communications in Computer and Information Science*, vol. 352 CCIS, pp. 283–288, 2012, Cited by: 4. DOI: 10.1007/978-3-642-35603-2_42.

[47] T. L. Holtze, "The web designer's guide to color research," *Internet Reference Services Quarterly*, vol. 11, no. 1, pp. 87–101, 2006, Cited by: 12. DOI: 10.1300/J136v11n01_07.

[48] Design Council, *A framework for innovation*, https://www.designcouncil.org.uk/our-resources/framework-for-innovation/, Accessed: 2025-01-30, n.d.

[49] S.-W. Hsiao and Y.-J. Tsai, "Application of multi-diamond processing model to hairstyling," *Engineering Proceedings*, vol. 74, no. 1, 2024, Cited by: 0; All Open Access, Hybrid Gold Open Access. DOI: 10.3390/engproc2024074021.

[50] J. Zimmerman, J. Forlizzi, and S. Evenson, "Research through design as a method for interaction design research in hci," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI '07, San Jose, California, USA: Association for Computing Machinery, 2007, pp. 493–502, ISBN: 9781595935939. DOI: 10.1145/1240624.1240704. [Online]. Available: https://doi.org/10.1145/1240624.1240704.

[51] W. Gaver, "What should we expect from research through design?" In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI '12, Austin, Texas, USA: Association for Computing Machinery, 2012,

pp. 937–946, ISBN: 9781450310154. DOI: 10.1145/2207676.2208538. [Online]. Available: https://doi.org/10.1145/2207676.2208538.

[52] M. MAGUIRE, "Methods to support human-centred design," *International Journal of Human-Computer Studies*, vol. 55, no. 4, pp. 587–634, 2001, ISSN: 1071-5819. DOI: https://doi.org/10.1006/ijhc.2001.0503. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1071581901905038.

[53] S. Berkun. "Design critiques: Encourage a positive culture to improve quality." Accessed: 2025-05-02, Nielsen Norman Group. (2009), [Online]. Available: https://www.nngroup.com/articles/design-critiques/.

[54] S. Sanyal, S. Banerjee, and P. K. Kalra, "Designing quality walkthroughs," *Computer Animation and Virtual Worlds*, vol. 18, no. 4-5, pp. 527–538, 2007, Cited by: 1; All Open Access, Bronze Open Access. DOI: 10.1002/cav.214.

[55] J. W. Knopf, "Doing a literature review," *PS: Political Science and Politics*, vol. 39, no. 1, pp. 127–132, 2006, ISSN: 10490965, 15375935. [Online]. Available: http://www.jstor.org/stable/20451692 (visited on 02/14/2025).

[56] B. DiCicco-Bloom and B. F. Crabtree, "The qualitative research interview," *Medical Education*, vol. 40, no. 4, pp. 314–321, 2006. DOI: https://doi.org/10.1111/j.1365-2929.2006.02418.x. eprint: https://asmepublications.onlinelibrary.wiley.com/doi/pdf/10.1111/j.1365-2929.2006.02418.x. [Online]. Available: https://asmepublications.onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2929.2006.02418.x.

[57] INTRAC, *Quantitative and qualitative methods*, https://www.intrac.org/resources/quantitative-and-qualitative-methods/, Accessed: 2025-05-02, n.d. [Online]. Available: https://www.intrac.org/resources/quantitative-and-qualitative-methods/.

[58] S. Kunifuji, "A japanese problem-solving approach: The kj ho method," *Advances in Intelligent Systems and Computing*, vol. 364, pp. 165–170, 2016, Cited by: 10. DOI: 10.1007/978-3-319-19090-7_13.

[59] T. Yasuhara, T. Sone, M. Konishi, *et al.*, "Studies using text mining on the differences in learning effects between the kj and world café method as learning strategies," *Yakugaku Zasshi*, vol. 135, no. 5, pp. 753–759, 2015, Cited by: 5; All Open Access, Gold Open Access. DOI: 10.1248/yakushi.14-00229.

[60] M. Naeem, W. Ozuem, K. Howell, and S. Ranfagni, "A step-by-step process of thematic analysis to develop a conceptual model in qualitative research," *International Journal of Qualitative Methods*, vol. 22, p. 16 094 069 231 205 789, 2023. DOI: 10.1177/16094069231205789. [Online]. Available: https://doi.org/10.1177/16094069231205789.

[61] R. P. Loweth, S. R. Daly, J. Liu, and K. H. Sienko, "Student practices developing needs statements for design problems," Cited by: 4, vol. 2020-June, 2020.

[62] M. Soares and J. Vrancken, "Model-driven user requirements specification using sysml," *Journal of Software*, vol. 3, Jun. 2008. DOI: 10.4304/jsw.3.6.57-68.

[63] C. O'Leary, F. Mtenzi, and C. McAvinia, "Towards reusable personas for everyday design," Cited by: 9, vol. 07-12-May-2016, 2016, pp. 2915–2922. DOI: 10.1145/2851581.2892411.

[64] Y.-K. Lim and K. Sato, "Describing multiple aspects of use situation: Applications of design information framework (dif) to scenario development," *Design Studies*, vol. 27, no. 1, pp. 57–76, 2006, Cited by: 39. DOI: 10.1016/j.destud.2005.04.004.

[65] W. Hudson, "User stories don't help users: Introducing persona stories," *Interactions*, vol. 20, no. 6, pp. 50–53, 2013, Cited by: 29. DOI: 10.1145/2517668.

[66] P. Achimugu, A. Selamat, R. Ibrahim, and M. N. Mahrin, "A systematic literature review of software requirements prioritization research," *Information and Software Technology*, vol. 56, pp. 568–585, 2014, ISSN: 0950-5849. DOI: https://doi.org/10.1016/j.infsof.2014.02.001. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0950584914000354.

[67] K. Österlin, *Design i fokusVarför ser saker ut som de gör?* 4:1. Kenneth Österlin och Liber AB, 2016.

[68] C. E. Wilson, "Brainstorming pitfalls and best practices," *Interactions*, vol. 13, no. 5, pp. 50–63, Sep. 2006, ISSN: 1072-5520. DOI: 10.1145/1151314.1151342. [Online]. Available: https://doi.org/10.1145/1151314.1151342.

[69] Google, *Crazy 8s*, Accessed: 2025-02-14, n.d. [Online]. Available: https://designsprintkit.withgoogle.com/methodology/phase3-sketch/crazy-8s.

[70] S. Stahlke, A. Nova, and P. Mirza-Babaei, "Artificial players in the design process: Developing an automated testing tool for game level and world design," Cited by: 21, 2020, pp. 267–280. DOI: 10.1145/3410404.3414249.

[71] M. Maguire, "An exploration of low-fidelity prototyping methods for augmented and virtual reality," *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 12201 LNCS, pp. 470–481, 2020, Cited by: 7. DOI: 10.1007/978-3-030-49760-6_33.

[72] C. Cox, B. Hicks, and J. Gopsill, "Improving mixed-reality prototyping through a classification and characterisation of fidelity," Cited by: 9; All Open Access, Hybrid Gold Open Access, vol. 2, 2022, pp. 353–362. DOI: 10.1017/pds.2022.37.

[73] J. Rudd, K. Stern, and S. Isensee, "Low vs. high-fidelity prototyping debate," *Interactions*, vol. 3, no. 1, pp. 76–85, Jan. 1996, ISSN: 1072-5520. DOI: 10.1145/223500.223514. [Online]. Available: https://doi.org/10.1145/223500.223514.

[74] D. Wallach, J. Conrad, and T. Steimle, "The ux metrics table: A missing artifact," *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 10288 LNCS, pp. 507–517, 2017, Cited by: 13. DOI: 10.1007/978-3-319-58634-2_37.

[75] F. Staiano, *Designing and Prototyping Interfaces with Figma: Learn essential UX/UI design principles by creating interactive prototypes for mobile, tablet, and desktop*. Packt Publishing, 2022, ISBN: 9781800561922. [Online]. Available: https://books.google.se/books?id=GOBeEAAAQBAJ.

[76] L. P. Wong, "Focus group discussion: A tool for health and medical research," *Singapore Medical Journal*, vol. 49, no. 3, pp. 256–261, 2008, Cited by: 417.

[77] G. Rodríguez-Perujo, I. Rodrigo-Martin, and D. Muñoz-Sastre, "Typologies and patterns of information architecture in the user interfaces of metas social networks (instagram); [tipologías y patrones de arquitectura de la información presentes en las interfaces de usuario de las redes sociales de meta (instagram e facebook)]," *VISUAL Review. International Visual Culture Review / Revista Internacional de Cultura*, vol. 16, no. 6, pp. 211–227, 2024, Cited by: 0. DOI: 10.62161/revvisual.v16.5368.

[78] "Reactive flow diagrams," *Advanced Textbooks in Control and Signal Processing*, no. 9781846288722, pp. 63–67, 2007, Cited by: 0. DOI: 10.1007/978-1-84628-877-7_6.

[79] J. Rubin, D. Chisnell, and J. Spool, *Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests*. John Wiley & Sons, 2008, ISBN: 9781118080405. [Online]. Available: https://ebookcentral.proquest.com/lib/chalmers/detail.action?docID=343716.

[80] S. Riihiaho, *RIIHIAHO 2015 Doctoral-thesis*. Jun. 2015, ISBN: 978-952-60-6227-3.

[81] J. Ramey, T. Boren, E. Cuddihy, *et al.*, "Does think aloud work? how do we know?," Cited by: 33; All Open Access, Green Open Access, 2006, pp. 45–48. DOI: 10.1145/1125451.1125464.

[82] J. R. Lewis, "The system usability scale: Past, present, and future," *International Journal of Human-Computer Interaction*, vol. 34, no. 7, pp. 577–590, 2018, Cited by: 941. DOI: 10.1080/10447318.2018.1455307.

[83] J. Brooke, "Sus – a quick and dirty usability scale," in Jan. 1996, pp. 189–194.

[84] J. Sauro, *Measuring usability with the system usability scale (sus)*, Accessed: 2025-05, 2011. [Online]. Available: https://measuringu.com/sus/.

[85] T. Wahyuningrum, N. A. Prasetyo, G. F. Fitriana, *et al.*, "Logistic regression analysis of factors that influence user experience in student medical report applications," *Journal of Applied Data Sciences*, vol. 5, no. 3, pp. 1210–1222, 2024, Cited by: 0; All Open Access, Gold Open Access. DOI: 10.47738/jads.v5i3.285.

[86] K. Setemen, L. J. Erawati Dewi, and I. K. Purnamawan, "Paon usability testing using system usability scale," *Journal of Physics: Conference Series*, vol. 1165, no. 1, p. 012 009, Feb. 2019. DOI: 10.1088/1742-6596/1165/1/012009. [Online]. Available: https://dx.doi.org/10.1088/1742-6596/1165/1/012009.

# A

# Project Plan

Presented in Figure A.1 is the planned project timeline. Underneath, in Figure A.2, is the final version of the timeline, displaying the actual process timeline of the study.

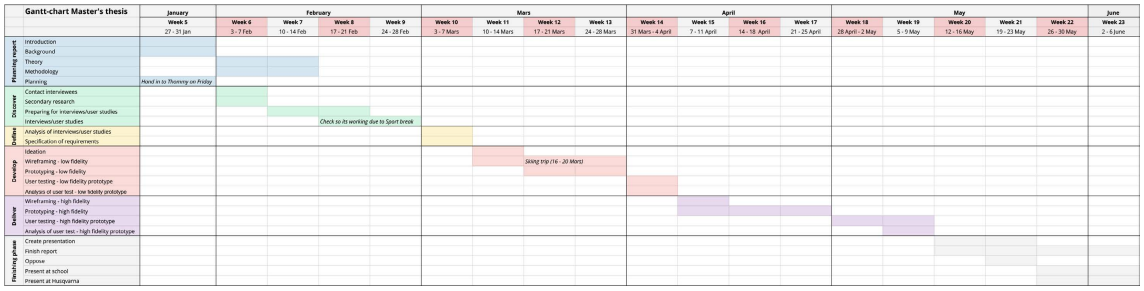


Figure A.1: Gantt-chart, initial

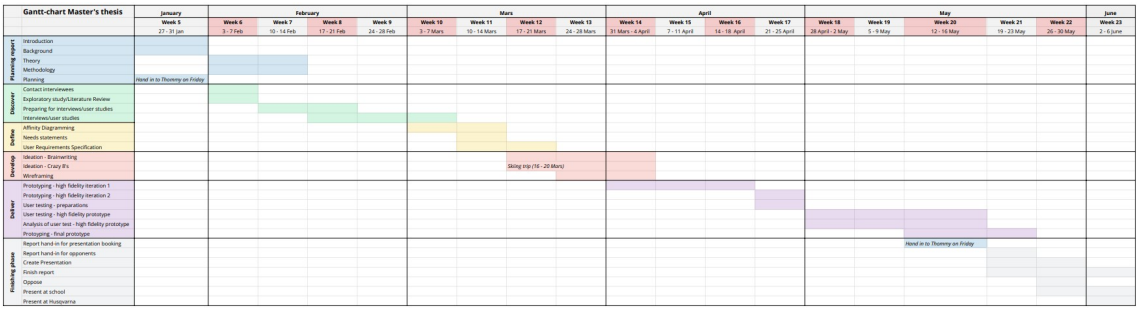


Figure A.2: Gantt-chart, final version

# B

# Interview Guide

This chapter presents the interview guide used for all interviews in the study.

We are studying our final semester at Chalmers University of Technology and are currently working on our thesis in collaboration with Husqvarna. The purpose of the project is to investigate how Husqvarna Fleet Service can be better adapted to the needs of those who work professionally in forestry and tree care. The interview will take approximately one hour and you are free to stop whenever you want to.

We will first ask you to read through and if you consent, sign this informed consent form.

**Consent for the Collection of Personal Data and Information**

*I hereby consent that Husqvarna Group and the project group for the thesis are allowed to collect and use data, in the form of notes, audio recordings, photographs, and video clips, from this interview and observation for the following project.*

*You have the right to withdraw at any time during the interview and observation. The collected data and your personal information will be stored until the project is completed by Husqvarna Group. Questions regarding the collected data should be directed to jacob.krantz@husqvarnagroup.com.*

The interview includes several sections regarding different areas of your work and the machines. Are you ready to begin the interview?

**Work and Workday**

1. What do you work with?
2. Can you describe what a workday looks like for you?
   (a) Preparations
   (b) How do you get a job?
   (c) How do you know which trees to take down/treat?
   (d) Equipment

   (e) Climbing in the trees
   (f) Down on the ground
3. How do you plan before you go out on a job?
4. How big is the company you work for?
5. What is the difference between small and large companies in the industry?

**Machines**

6. What machines do you use?
   (a) Do you use battery-powered or gasoline-powered machines?
   (b) How do you keep track of your batteries?
   (c) How many machines do you have?
   (d) How are the different machines used in different situations?
7. Do you own your machines or do you borrow/rent them from another company?
   (a) How do you keep them organized?
8. How do you keep track of the service and maintenance of your chainsaw and other machines?
9. Do you service your machines yourself or does someone else do it?
   (a) How do you get in touch with service?
10. How do you handle problems or faults with your equipment?
11. How do you order/buy spare parts?
   (a) Is it difficult to know which spare parts fit?
12. Is there anything specific about your machines that we have missed asking about?

**Other Equipment**

13. Do you use any other equipment? What kind of equipment?
14. How do you keep track of the maintenance and inspection of your equipment (e.g., harnesses, ropes, carabiners, and climbing equipment)?
15. Is there any equipment you find particularly difficult to keep track of or manage? What? Why?

**Communication and Collaboration**

16. How many people work together?

17. What does your collaboration look like?
18. How do you communicate?
19. How do you divide the work?

**Problems and Challenges**

20. Do you encounter problems in your work that you need to solve yourself?
    (a) What kind of problems can it be?
    (b) How do you solve them?
    (c) Is there anything that could help you with such a problem?
21. What are the biggest challenges you face in your work?
    (a) In planning
    (b) In preparations at the workplace
    (c) Down on the ground
    (d) Climbing in the trees
    (e) When machines are used
    (f) In collaboration with colleagues
22. How do you document safety-related incidents?
23. Is there anything you often need to look up or check before or during a workday?

**Digital Tools**

24. Have you used Husqvarna Fleet Services™?
    (a) If yes; which functions do you use?
        i. When do you use the service?
        ii. Is there anything you find complicated in the existing app?
        iii. What works well in the app?
    (b) If no; why haven't you used the app?
25. Have you used Husqvarna Connect?
    (a) If yes; which functions do you use?
        i. When do you use the service?
        ii. Is there anything you find complicated in the existing app?
        iii. What works well in the app?

   (b) If no; why haven't you used the app?

26. Do you use any other digital tools or apps in your work today? Which ones?
   (a) When do you use the service?
   (b) What works well with these?
   (c) What do you miss?
   (d) Is there anything you find complicated with existing digital solutions?
27. Are there specific functions in an app that would make your workday easier?
   (a) Which is the most important?
28. What information about your chainsaw or other machines would you like to have easily accessible in an app?
   (a) Which machine data is important to you?

**Important Information and Data**

29. Do you see any disadvantages with being connected with your machines and their GPS position to an app?
30. How do you feel about Husqvarna using your machine data related to the product to develop the products?
31. Is there anything else you think we should consider when developing an app?
32. Is there anything else you would like to add?

# C

# Brainwriting

In Figure C.1 to Figure C.3, the result of the Brainwriting session is shown. The 15 boxes represents each category of requirements and the ideas generated from its requirements. Marked in green are the categories containing the most feasible and relevant ideas for this project. These were further elaborated in the in the Crazy 8's method.

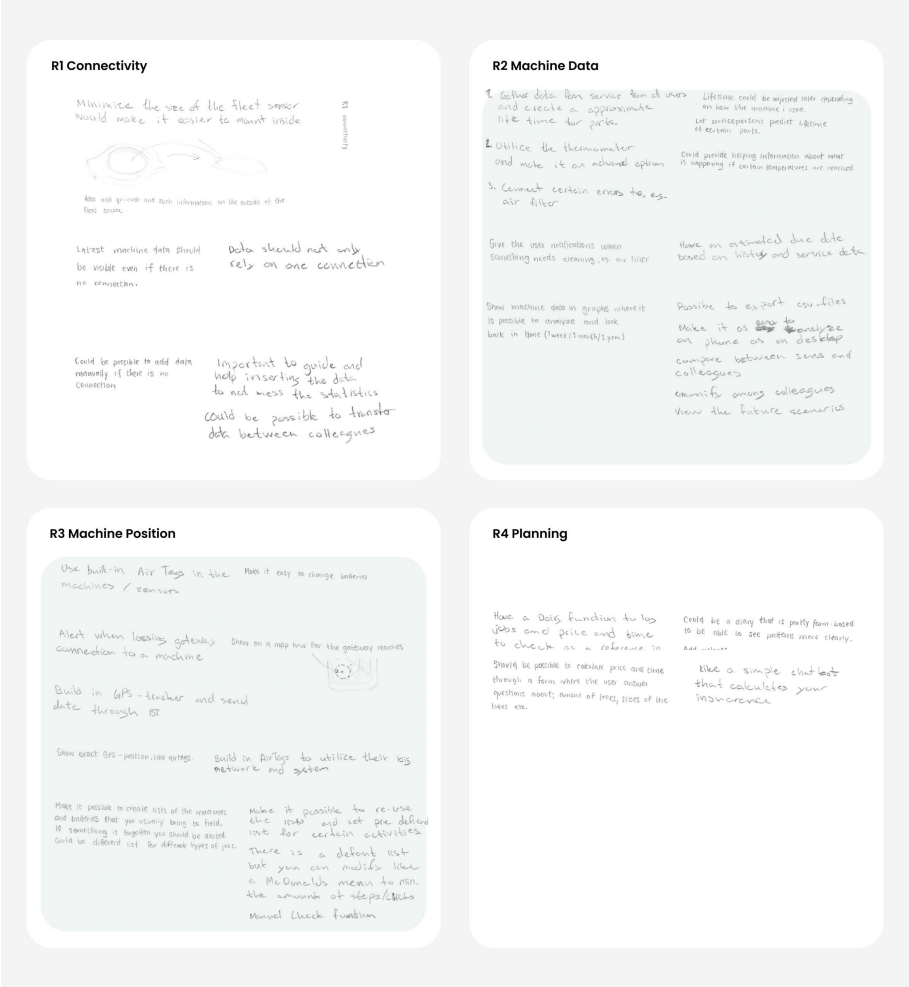


Figure C.1: Brainwriting based on the requirement groups *R1* through *R4*.


Figure C.2: Brainwriting based on the requirement groups *R5* through *R10*.


Figure C.3: Brainwriting based on the requirement groups *R11* through *R15*.

# D

# Crazy 8's

Presented in Figure D.2 to Figure D.8 is the sketches generated during the Crazy 8's ideation session. Marked in green are the ideas that were identified as the most promising and created the foundation for the prototyping.

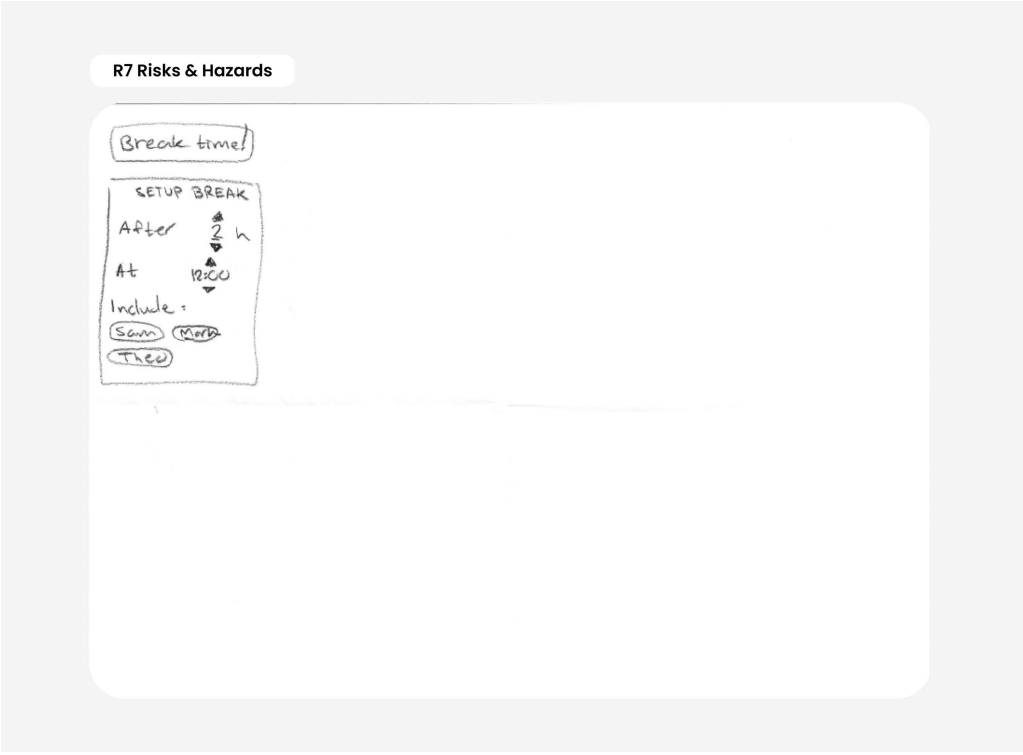


Figure D.1: Crazy 8's based on the requirements in *R7*


Figure D.2: Crazy 8's based on the requirements in *R2*

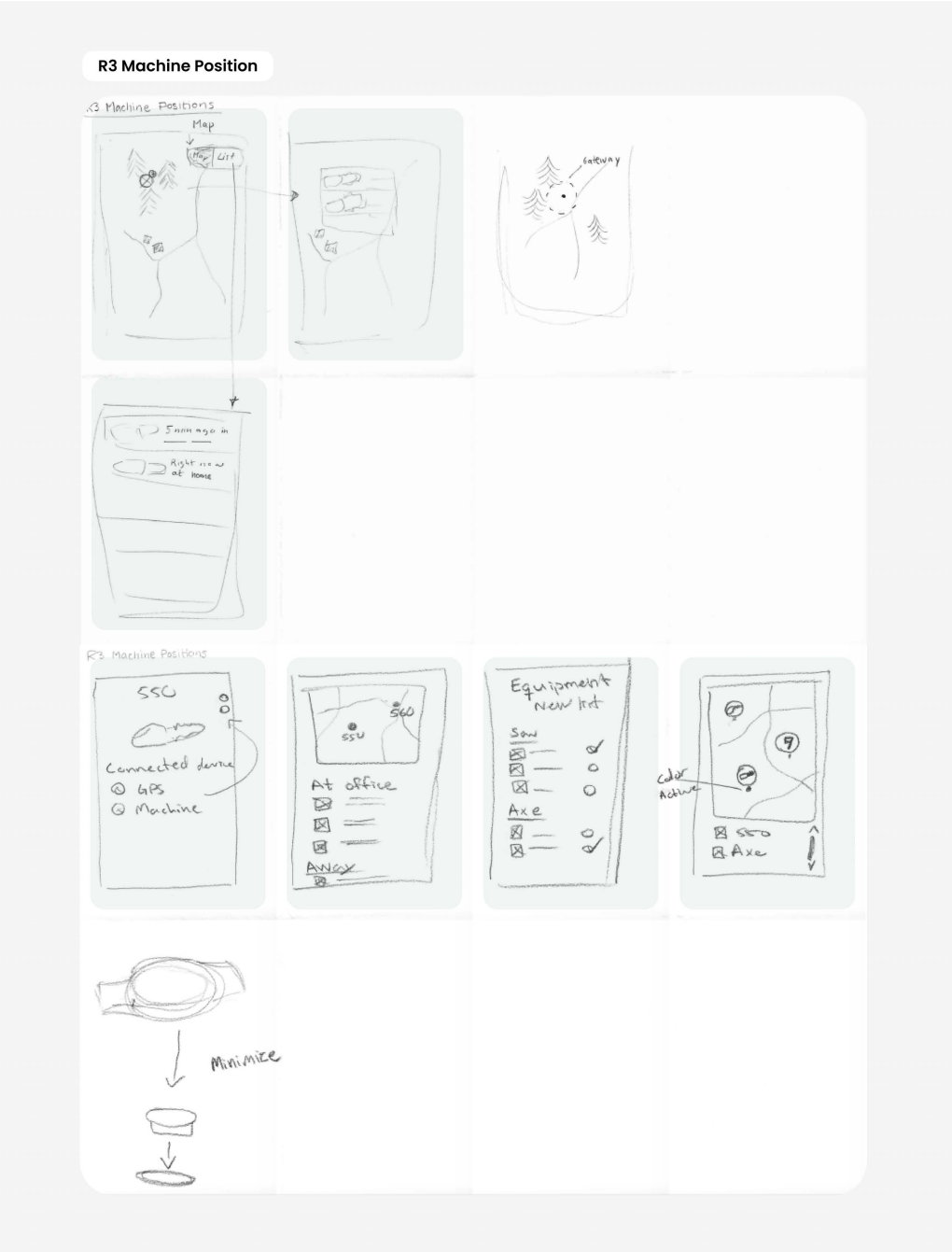


Figure D.3: Crazy 8's based on the requirements in *R3*


Figure D.4: Crazy 8's based on the requirements in *R5*


Figure D.5: Crazy 8's based on the requirements in *R6*


Figure D.6: Crazy 8's based on the requirements in *R8*


Figure D.7: Crazy 8's based on the requirements in *R9*


Figure D.8: Crazy 8's based on the requirements in *R11*

# E

# IA Map

The Information Architecture map (IA map), was created to structure the prototype and get a better view of the flow. It helped identifying improvements in the before the second iteration of the prototype.

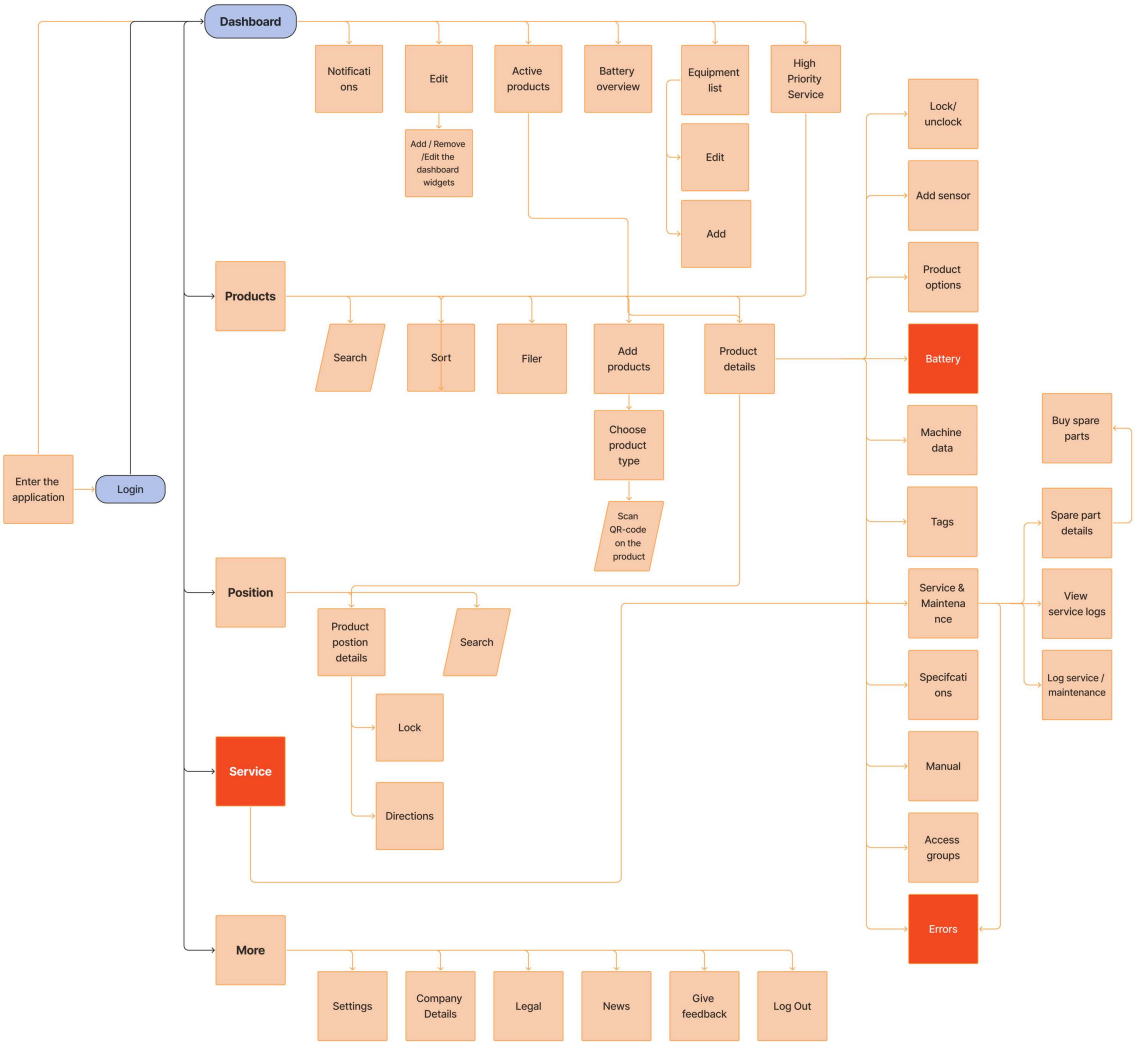


Figure E.1: IA Map of the user flow after the first prototype.

# F

# User testing

Presented below is the guide used for all user testing, both the end-user testing and the expert testing.

**Products**

1. Go to Products
   (a) What information does Peters 540 convey?
2. Enter Peters 540
   (a) What can you do on this page?
   (b) Would you use these features?
   (c) Are you missing any features?
3. Go to Service & Maintenance
   (a) What information do you get here?
   (b) Is the information useful?
   (c) Are you missing anything?
4. Add a new service/maintenance in the app.
   (a) Is there anything difficult to understand?
   (b) Is there anything unnecessary to add?
   (c) Is there anything missing?
5. Save the activity.
6. Go to Spare Part Details
   (a) Is anything unclear?
   (b) What do you think happens if you press the orange icon? (You will be taken to the products page in the browser where you can order/check more about it, what do you think about that?)

   (c) Are you missing anything here?

7. Click around between the different tabs.
   (a) During our data collection, we understood that you have a need to find frequently purchased spare parts and to check specific spare parts on exploded views, do you think this function meets that need?
8. Go back to the product page for Peters 540
9. Press machine data
   (a) What information do you get here?
   (b) Is this information necessary?
   (c) Are you missing any information?
   (d) Is the information clear and easy to understand?
10. Find Peters battery 1 in the product list and enter it.
   (a) What information do you get on this page?
11. Press "Add label"
12. Choose the orange label and give it a name.
13. Save the label
   (a) When we conducted user studies, we saw a need to distinguish your batteries from others batteries. Therefore, we have developed a solution where you get labels in a bunch of different colors when you buy batteries from Husqvarna that you can write names on, and also add the same label to the batteries in the app to keep track of them.
   (b) What do you think about that?
   (c) Would you have used labels if they were available?
   (d) Do you think this solution meets the user need to distinguish your batteries?

**Position**

1. Go to the Position tab
   (a) What information do you get here?
2. Press the riding mower on the map
   (a) What information do you get here?
   (b) Are you missing anything?
   (c) During data collection, we found a need to track your products in real-time, to be able to lock the products, and to be reminded if products are forgotten. Do you think this function meets those needs?

#### Profile

1. Go to the Profile tab
   (a) What can you do here?
   (b) Is anything unclear?
   (c) Are you missing anything?

#### Dashboard

1. Go to the Dashboard tab
   (a) What information do you get here?
   (b) Is this the information you would have wanted on a dashboard?
   (c) Are you missing anything?
2. Edit the dashboard
   (a) Is it clear how to remove, add, and edit widgets?
   (b) Is it good to be able to personalize how your dashboard should look?
   (c) Are you missing anything?
3. Go back to the Dashboard
   (a) What do you think Equipment List means?
4. Edit Peters Arborist Equipment
   (a) What information do you get here?
   (b) Is the page easy to understand?
   (c) What do you think about Reminders?
   (d) Would you have used such a list?
   (a) Add some products to the list and Save.

### System Usablity Scale

Now you we would like you to answer a ten question questionnaire.

#### General questions

1. Would it have simplified your workday?
2. Does it feel tailored to you and your profession?
3. Are you missing any important features?
4. Is there any unnecessary information?
5. Is there anything else you want to add?