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Forestry work management system with integrated maps

Project proposal for web applications in C# course

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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1 Introduction

Having been in touch with a company that offers different forestry services, but mainly clearing small trees, bushes and brushes that get in the way of the harvesters when they are cutting the actual trees that can be used for material, it's clear that the process can be streamlined by quite a lot.

Currently all the communication is done via email or phone and workers use many different applications to fulfil their needs.

The goal of this project would be to improve the company's business processes bring everything together in a single environment. This would greatly increase the company's potential for growth since the current way of doing things via phone or email is not really scalable. If operations can be performed in one environment, it would be much easier. Also, some of the work is directed from the supervisor to the worker since the worker will now directly upload their work to the application.

2 Overview

Currently the company's whole work process is done via email or phone. The clients send data about what cadastral units need to be cleared and when. The information gets relayed to a few workers via email or phone. The workers do their job while carrying GPS devices that track their progress during work. After work, they send their GPS tracks to their supervisor who enters them into a map application that's usually provided by the GPS maker company. The supervisor takes a screenshot of the tracks and sends it to the client as proof of work and that the cadastral unit is ready to be harvested.

This could be streamlined with a work management application that uses maps with cadastral data layers.

Cadastral data map layers are provided free of charge by the Estonian land board [1]. The data can be used to setup an instance of GeoServer. GeoServer allows us to set up a Web Map Service that allows us to use the data with our web application maps [2]. This is required to show data about all the cadastral units on the map and searching for them by given cadastral unit IDs.

Different cadastral units that need to be cleared will be setup as worksites and workers will be assigned to them. Workers can see what jobs they are assigned to and when are the deadlines. After some progress they can directly upload their GPS tracks under the given worksite which will show their tracks in our web application. The uploaded GPS tracks will be converted into GeoJSON [3] and saved to the database. This allows us to keep all the tracks in our database and show it on a map whenever we need to.

When the work on a worksite is done the application can generate and send an invoice for the client along with proof of work images.

The application would also be used to manage workers, tools, different job types and statistics.

Ideally you could also upload images to better identify workers and specific tools.

3 Scope of work

Most of what was described in the previous chapter is required to streamline the progress of the company but there are some parts that can be pushed out of the minimal viable product.

Managing entities like worksites, workers, tools and so on should be included in the MVP because that builds the foundation on which the processes run.

Some more complex map functionalities could be postponed if there isn't enough time to implement them properly. For example uploading GPS tracks, converting them to GeoJSON, saving the data and then showing the tracks on a map could be one of the more difficult tasks in this project. If there is no time to implement this then as a substitute workers could insert a numerical value in hectares – showing how much work they did and how the work has progressed on the given worksite.

One map functionality that could be left out of the minimal viable product would be the search functionality on the main map. Alternatively the search could be performed on Estonian land board provided maps and then the location could be found inside our application.

Uploading images for workers and tools would be nice to have as well but will be left out of the scope for the time being. Setting up a file server like Amazon S3 and integrating it with our application would take us time that would be better spent on the actual functionalities that help the company's business processes.

Design is also something that we could save some time on. There is a design prototype in the appendix that describes the initial vision for the application but to save time it might be wise to focus more on the functionality and less on getting the design perfect.

The application consists broadly of 4 parts. The front end, the back end, the database and an instance of GeoServer.

4 Design prototype

A design prototype was made as part of the project proposal (see Appendix 1 to 9). It shows the main views of the application along with the main colours used in the design.

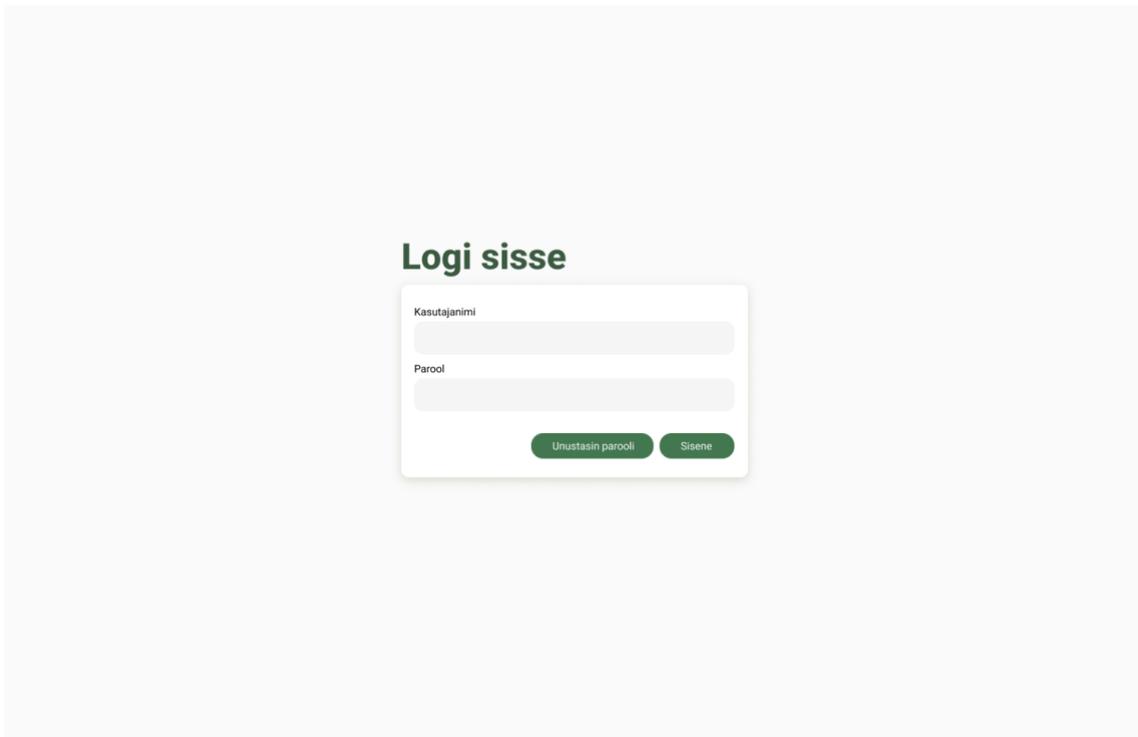
5 Initial entity relationship diagram

An initial entity relationship diagram was composed to visualize how the data should be stored (see Appendix 10). The initial version will change during the course of the project.

6 References

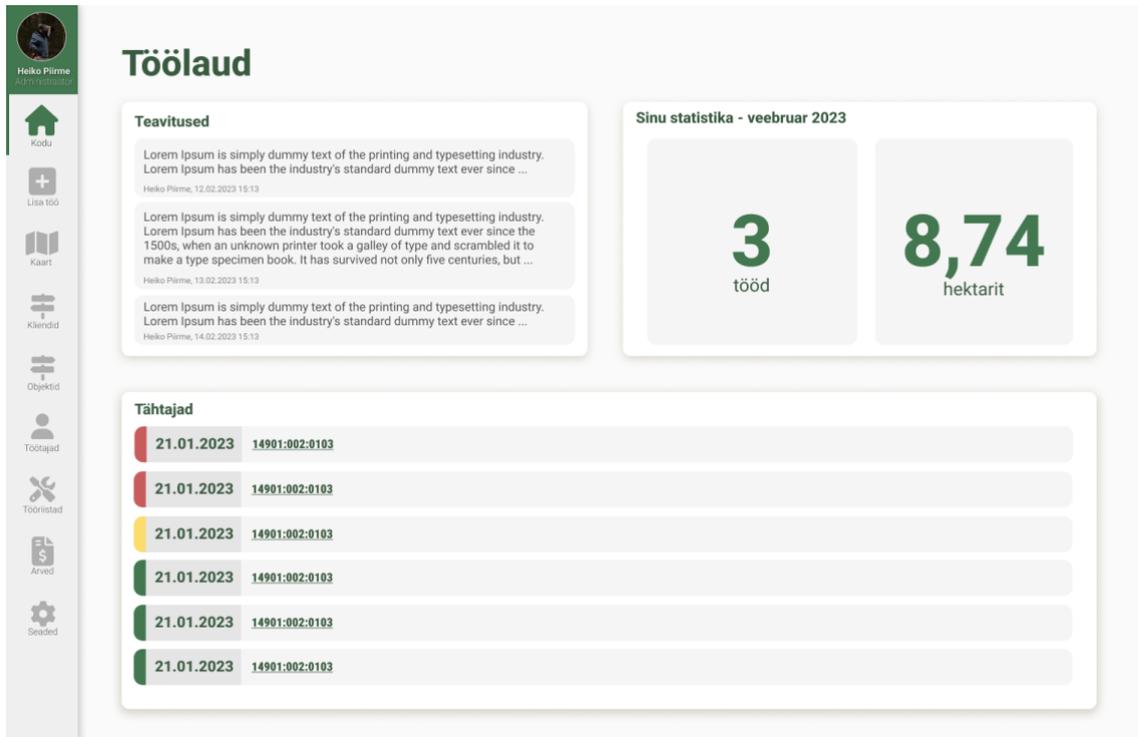
- [1] "Cadastral data," 18. 02. 2023. [Online]. Available: <https://geoportaal.maaamet.ee/eng/Spatial-Data/Cadastral-Data-p310.html>.
- [2] "GeoServer," [Online]. Available: <https://geoserver.org/about/>. [Accessed 18. 02. 2023].
- [3] "GeoJSON," [Online]. Available: <https://geojson.org/>. [Accessed 18. 02. 2023].

Appendix 1 – Login page design



The image shows a login page design with a light gray background. At the top center, the text "Logi sisse" is displayed in a bold, dark green font. Below this, there is a white rectangular form with rounded corners and a subtle drop shadow. Inside the form, the label "Kasutajanimi" is positioned above a light gray input field. Below that, the label "Parool" is positioned above another light gray input field. At the bottom of the form, there are two green buttons with white text: "Unustasin parooli" on the left and "Sisene" on the right.

Appendix 2 – Home dashboard design



Appendix 5 – Adding a worksite design

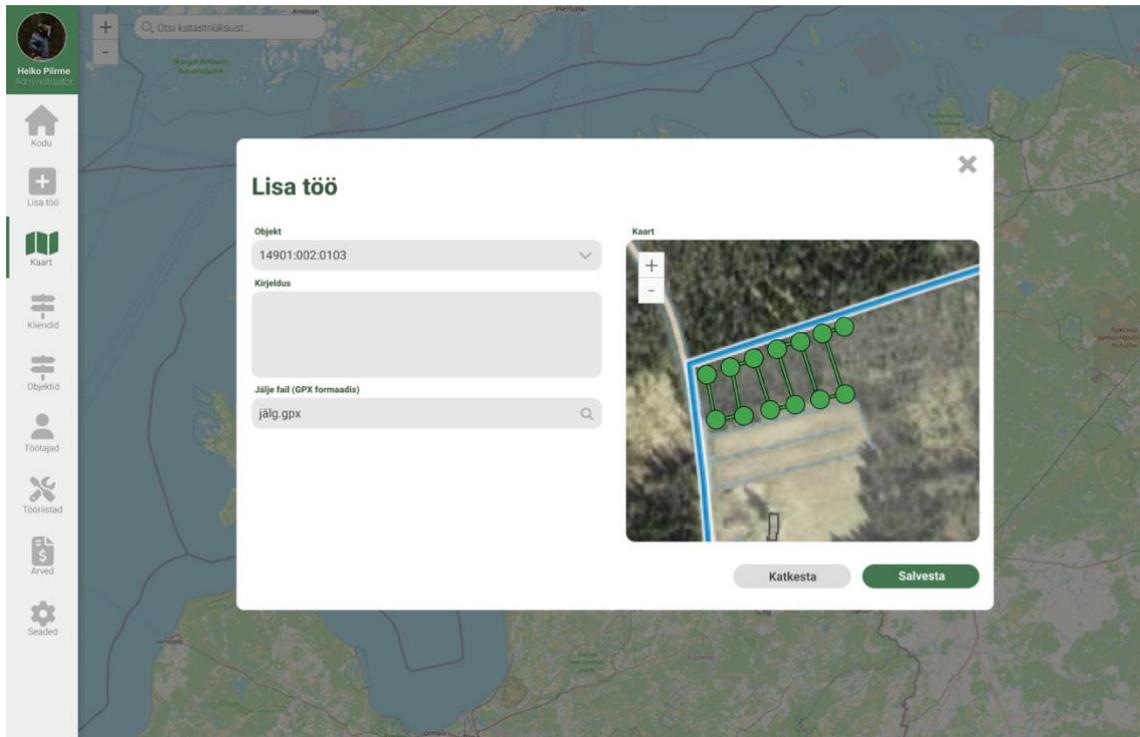
The screenshot displays a web application interface for managing worksite objects. On the left is a sidebar with navigation icons: Home, Add new, Map, Clients, Objects, Workers, Tools, Expenses, and Settings. The main area is titled 'Objektid' and contains a table with columns: Tunnus, Pindala, Tähtaeg, Alustatud, Lõpetatud, and Hilisem töö. A modal window 'Lisa uus objekt' is open, showing a form with the following fields:

- Tunnus: 14901.002.0103
- Klient: [dropdown]
- Töö tüüp: [dropdown]
- Tähtaeg: 25.09.2023
- Pindala hektarites: 3,4
- Määratud töötajad: H.Piirne, J.Tamm

Below the form is a map labeled 'Kaart' showing a satellite view with a blue rectangular selection. At the bottom of the modal are 'Katkesta' and 'Salvesta' buttons. The table below the modal shows two rows of data:

| Tunnus | Pindala | Tähtaeg | Alustatud | Lõpetatud | Hilisem töö |
|----------------|---------|------------|------------------|-----------|------------------|
| 14901-002-0103 | 3,54 ha | 23.11.2023 | 12.02.2023 16:15 | | 24.02.2023 14:15 |
| 14901-002-0103 | 3,54 ha | 23.11.2023 | 12.02.2023 16:15 | | 24.02.2023 14:15 |

Appendix 6 – Add work design



Appendix 8 – Tools overview design

Tööriistad [+ Lisa uus](#)

| Nimetus | Kood | Tüüp | Lisatud |
|----------------------|------|------------|------------------|
| Husqvarna saag | HS1 | mootorsaag | 12.02.2023 16:15 |
| Husqvarna võsalõikur | HV1 | võsalõikur | 12.02.2023 16:15 |
| Husqvarna saag | HS1 | mootorsaag | 12.02.2023 16:15 |
| Husqvarna võsalõikur | HV1 | võsalõikur | 12.02.2023 16:15 |
| Husqvarna saag | HS1 | mootorsaag | 12.02.2023 16:15 |
| Husqvarna võsalõikur | HV1 | võsalõikur | 12.02.2023 16:15 |
| Husqvarna saag | HS1 | mootorsaag | 12.02.2023 16:15 |
| Husqvarna võsalõikur | HV1 | võsalõikur | 12.02.2023 16:15 |
| Husqvarna saag | HS1 | mootorsaag | 12.02.2023 16:15 |
| Husqvarna võsalõikur | HV1 | võsalõikur | 12.02.2023 16:15 |
| Husqvarna saag | HS1 | mootorsaag | 12.02.2023 16:15 |
| Husqvarna võsalõikur | HV1 | võsalõikur | 12.02.2023 16:15 |
| Husqvarna saag | HS1 | mootorsaag | 12.02.2023 16:15 |
| Husqvarna võsalõikur | HV1 | võsalõikur | 12.02.2023 16:15 |
| Husqvarna saag | HS1 | mootorsaag | 12.02.2023 16:15 |
| Husqvarna võsalõikur | HV1 | võsalõikur | 12.02.2023 16:15 |

Appendix 9 – Settings overview design

The screenshot shows a user interface for the 'Seaded' (Settings) section. On the left is a vertical sidebar with a user profile at the top (Heiko Piirma) and several navigation icons: Home, Add, Map, Clients, Objects, Employees, Tools, Invoices, and Settings (highlighted). The main content area is titled 'Seaded' and is divided into two panels. The left panel, titled 'Tööriista tüüp', contains two buttons: 'Kulu tüüp' and 'Töö tüüp'. The right panel, titled 'Tööriista tüüp', features a search bar with the placeholder text 'Otsi nimetuse järgi...' and a '+ Lisa uus' button. Below the search bar is a table with two columns: 'Nimetus' and 'Tööriistade arv'. The table contains two rows of data.

| Nimetus | Tööriistade arv |
|------------|-----------------|
| mootorsaag | 5 |
| võsalõikur | 7 |

Appendix 10 – Initial entity relationship diagram

