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Production operations, work order, and job management system for the processing industry

Project proposal for the course ICD0024 Web applications with C#

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Tallinn 2025

List of abbreviations and terms

| | |
|-----|--------------------------------|
| BOM | Bill Of Materials |
| MVP | Minimum Viable Product |
| MDF | Medium Density Fireboard |
| CNC | Computer Numerical Control |
| WIP | Work In Progress |
| ERP | Enterprise Resource Management |

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1 Introduction

Process Industry by definition is a set of companies that are active in the transformations and formulations of raw materials using continuous and batch processes into materials or intermediates with new enhanced properties and functionalities [1]. According to Statistics Estonia, out of all manufacturing enterprises in 2023, 59% were in processing industry, having an annual turnover of 17 662 295 000 euros. [2]

Even for a small to medium-sized business, there is a need to find new ways to leverage data and process automation – or risk losing the competitive position in the global market. Furthermore, in process manufacturing, mistakes in design and production can be particularly expensive. Given that ingredients can't be remixed, there is a need to make sure products are made to spec, or risk waste and inefficiency as well as delays in time to market. [3]

Instead the assembling a product using components, which are described in BOM (Bill Of Materials) the processing companies have a series of operations to perform on the material. ERP (Enterprise Resource Management) software is often too complicated with tons of unnecessary features for small process industry companies. Production planning components provide a step-wise solution to pull items to be produced, fetch raw materials through their BOMs and check their availability in various warehouses. It enables contractors to request raw-materials and initiate Work Orders accordingly. [4] If production is like an orchestra, the Work Order is the conductor, coordinating all operations to ensure every action happens on time and in harmony.

During this project the author will implement an MVP (Minimum Viable Product) that will match with the needs of a small woodworking company in Estonia (see Figure 1 for an example Home Page). The firm owns a set of heavy machinery to manipulate timber, MDF (Medium Density Fireboard), plywood and other raw materials [5]. Some of the operations performed on the material includes sawing, precision cutting with CNC (Computer Numerical Control) machines, veneering, sanding, polishing and painting. They are the subcontractors for several companies that produce a variation of interior

fittings, sending out several pallets of processed semi-finished products every working day.

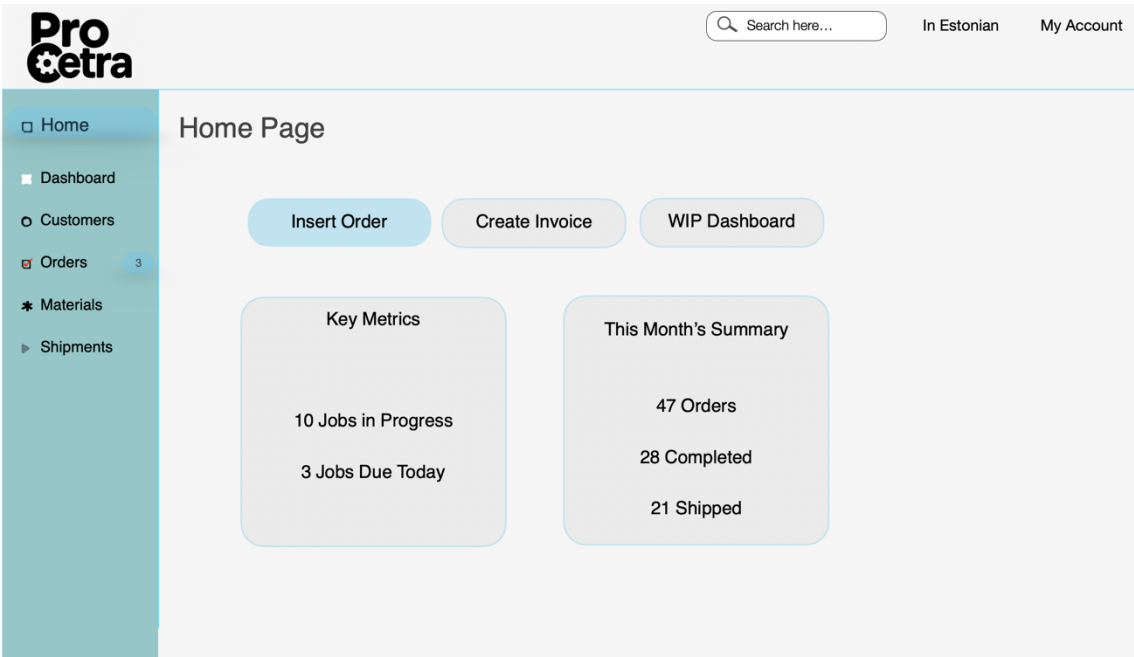


Figure 1. *An image of the Home Page.*

The particular woodworking company uses currently Microsoft Excel spreadsheets to keep track of incoming orders and once a job operation is finished, a worker fills a cell in the order-row with green color to mark it done. Once a week the accountant must go through several spreadsheets and e-mails, perform manual calculations and look for special price agreements. Compiling of the customer invoices takes on average 4 hours every week. With customized software these processes would be fast, streamlined, accurate and transparent.

2 Requirements for the software

The goal of this project is to develop a lightweight production workflow tracking software for a small woodworking company in process industry. It must be able to keep track of all the orders, processes and details in the similar manner as their current solution and streamline the data modifications and viewing dashboards on top of that. The MVP should be able to keep the data secure and accurate and save company's time by pre-calculating customer invoices.

For the main user, the contractor, it is essential to be able to see different summaries and states of the current orders. For example, the dashboard of WIP (Work In Progress): show all the customer orders that are yet to be completed, in the order of importance by the due date, and by the size of the job by square meters (see Figure 2 for the design). Larger jobs should be thereinbefore in the queue. For the pre-filled customer invoice, the software program should display all of the orders and their rows that are completely fulfilled, packed and sent, but haven't been billed for yet.

| Order nr | Customer | Deadline | Item | Amount | Material | m2 | Processes | Status |
|-------------|-----------|------------|-----------------------------|--------|----------|--------|---------------------------------------|-------------|
| 30375001 | BesDoor | 14.03.2025 | Detail nr 37 1565 x 1289 | 8 | MDF 8mm | 16,138 | ✓ CUT ✓ CNC ✓ PAINT | Completed |
| AMW-0471646 | Woodland | 14.03.2025 | 2175 x 265 | 1 | MDF 10mm | 0,576 | ✓ CUT ✗ CNC | In progress |
| AMW-0471646 | Woodland | 14.03.2025 | 785 x 250 | 2 | Ply 6mm | 0,393 | ✓ CUT ✓ CNC | Completed |
| 7193-0472 | Mainframe | 17.03.2025 | 6550 x 775 | 5 | Veneer | 2,538 | ✗ CUT ✗ CNC | In progress |
| 8546-9457 | Mainframe | 19.03.2025 | 2295 x 450 | 15 | Frame | 1,549 | ✓ CUT ✓ CNC ✗ PAINT | In progress |
| 30375002 | BesDoor | 19.03.2025 | 1355 x 1355 | 10 | MDF 10mm | 2,754 | ✗ CUT ✗ CNC | Cancelled |
| 7193-0480 | Mainframe | 20.03.2025 | 3105 x 965 | 5 | MDF 10mm | 1,498 | ✗ CUT ✗ CNC ✗ PAINT | In progress |
| 7193-0480 | Mainframe | 20.03.2025 | 2295 x 450 | 5 | MDF 10mm | 0,516 | ✗ CUT ✗ CNC ✗ PAINT ✗ LAQUER | In progress |
| ASG-0448275 | Woodland | 20.03.2025 | 2285 x 265 | 14 | MDF 10mm | 8,477 | ✗ CUT ✗ CNC | In progress |
| 8552-0287 | Mainframe | 21.03.2025 | 3000 x 4700 | 20 | Frame | 14,1 | ✗ PAINT | Pending |

Figure 2. A design of the Works In Progress Dashboard.

On the customer side, they should also be able to track the progress of their orders so they could predict the completion time and plan their shipments. One of the dashboards could include information about completed but unsent orders that are packed together on one pallet with their order names and pallet number (see Figure 3 for the design). Another to view the WIP-s: all the unfinished orders and their statuses and which of the processing steps are finished and when (see Figure 4 for the proposed layout). Additionally an option to be able to view any item with its history.

Some of the non-functional requirements include security as enterprise-specific information should not be accessible to non-related persons and reusability among other companies with similar needs.

| Order nr | Deadline | Item | Amount | Material | m2 | Processes | Status |
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Figure 3. A design of the Works In Progress Dashboard for the buyer.

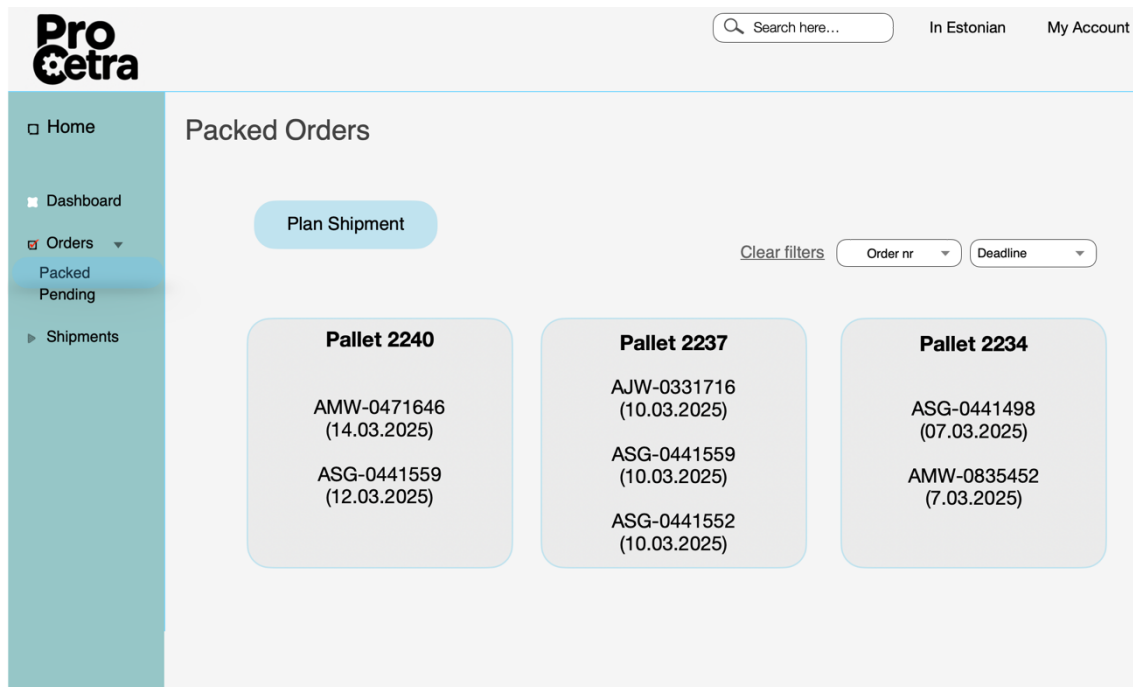


Figure 4. A buyer's view of the Packed Orders ready to be shipped.

3 Future developments

Inventory management in the warehouse module that can calculate and keep track the amount of raw materials at hand.

Prices and their special variations. For example sawing of the smaller details have their own price correlation coefficient because the job is more time-consuming despite of the lesser detail area.

Keeping track of suppliers, their prices and facilitating the initiation of the purchase orders.

References

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Appendix 1 ERD schema

