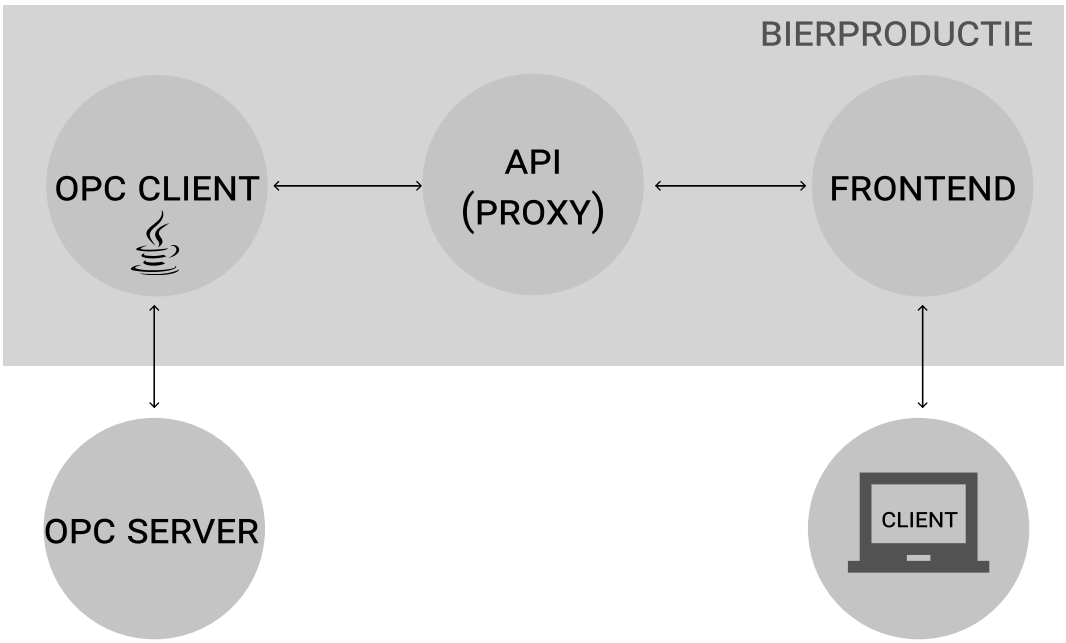
Bierproductie

A management system for brewing machines



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By signing this document, each group member confirms that everyone have participated equally to this project, and everyone is thus collectively responsible for the content of the report.

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5 Requirements

5.1 Overall Requirements Specification

5.1.1 Problem Statement

In the table 1, the finished problem, the problem statement and related questions are listed.

Problem	The current production line is not effecient enough to keep up with the demand of the beer, while still maintaining a quality product
Problem Statement	How to control and optimise the brewing machine, to maximise the production of high quality beer
Related questions	• How can we optimise the production? • How can we utilise calculus and linear algebra to provide a meaningful overview of the production line, based on statistics? • How can we create a web based frontend for the MES? • How can we separate the different aspects of the system (separation of concerns)

Table 1: Problem statement showcase

5.1.2 Summary of requirements

The group's proposed solution will adhere to the requirements given by the brewery Refslevbæk Bryghus A/S.
The manufacturing execution system, MES, must be able to control the brewery's production. It must be able to start and stop the production line, as well as monitor the production and collect data from the production line. The data must be stored for further analysis. The MES must be able to keep track of the batches that the new machine is producing, as well as collect various data from the machine that is associated with the current batch number. After a finished batch production, the MES must be able to produce a batch report. The report must contain the following.

- This Batch ID
- Product type
- Amount of products (total, defect and acceptable)
- Amount of time used in the different states
- Logging of temperature over the production time
- Logging of humidity over the production time

The MES/SCADA (Supervisory control and data acquisition) system must be able to monitor the production and display live relevant data from the machine. The documentation of the system must contain an illustration that defines the different components in the setup, in relation to the ISA88ˆ1213 Part 1 Physical Hierarchy model. The system must have a visualisation that can be accessed and used to display production data. The system must be able to collect the necessary data from the machine and calculate the overall equipment effectiveness, OEEˆ131516, of the machine. The OEE must be available to be displayed by the system. The system must be able to estimate the error function associated with the different products. The system must be able to find the optimal production speed for each product type, based on an error simulation and the appertaining graph upon which the error simulation is built.

5.1.3 List of requirements

Below is a list of the above requirements. These requirements have been prioritised using the MoSCoW method, where M is for Must have, S is for Should have, C is for could have, and W is for Won't have.

ID	Name	Description	Prio
R01	Control production line	Control the brewery's production	M
R02	Control production line	Start/stop production line	M
R03	Monitor production	Monitor data from the production line	M
R04	Monitor production	Store the collected data for further analysis	M
R05	Administer batches	Keep track of produced batches (batch ID)	M
R06	Store batch info	Collect various data associated with current batch number from the machine	M
R07	Batch report	Produce a batch report (PDF/dashboard style format)	M
R08	Live data	Monitor and display live relevant data from the machine	M
R09	Documentation	Documentation must contain an illustration that defines the different components in the setup in relation to the ISA88ˆ1213 Part 1 Physical Hierarchy model	M
R10	Visualisation	Visualisation that can be accessed and used to display the production data	M
R11	OEE	Collect necessary data from the machine and calculate the OEE. OEE must be available to be displayed by the system	M
R12	Estimate error function	Estimate the error function associated with the products	S
R13	Optimal Production speed	Estimate the optimal production speed for each product type	M

Table 2: List of requirements

5.2 Selected Detailed Requirements

5.2.1 Functional & Non-Functional Requirements

5.2.2 The Physical Setup (The Brewery Machine)

5.2.3 The Simulator

5.3 Use Cases

5.3.1 Actor List

5.3.2 Detailed Use Cases

From project description

5.3.3 Use Case Diagram

6 Analysis

6.1 Use Case analysis

6.1.1 Class Candidates

6.1.2 Description of Classes

6.1.3 UML Analysis Diagram

6.2 Use Case Realisation

6.2.1 Sequence Diagrams

6.2.2 Operation Contracts

6.2.3 Updated UML Class Diagram

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8 Design

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10 Verification & Validation

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