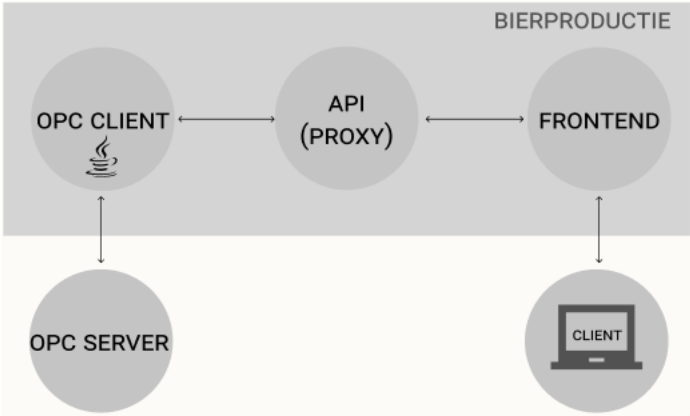
Bierproductie

A management system for brewing machines



Softwareteknologi

Semesterproject 3. semester, ST3-PRO

Project Period: 31.08.2020 - 19.12.2020

Hand in date: 19.12.2020

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Title: Bierproductie

Institution: University of Southern Denmark
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Education: Bachelor of Engineering in Software Technology

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Project Period: 31.08.2020 - 19.12.2020

ECTS: 10 ECTS

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Pages: 10
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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.

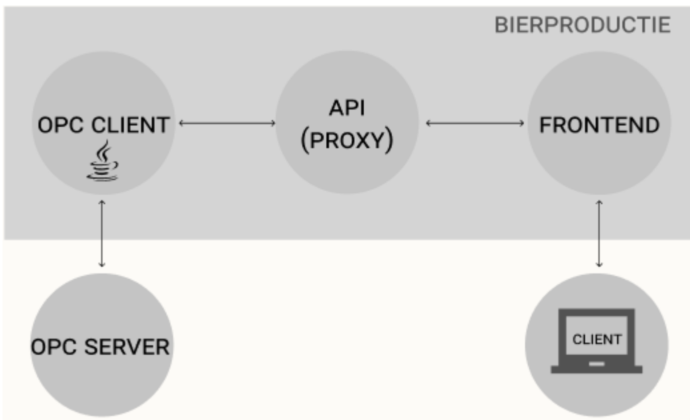
1 Motivation

As students, this semester project gives the group a great learning experience as well as a good idea of how such a project would progress. During the project, the group will learn how to create and setup a OPC-UA client, and how to make it communicate directly to a physical machine. The group will learn to host a webserver, from which the machine can be controlled, and access it as a website. The group will also have the chance to learn and use a new scripting language, JavaScript. The gained experience is the main motivation of this project.

2 Aim

This project aims to offer an interactive web interface for monitoring, controlling and adjusting the brewery machine. This is done by having the web interface interacting with a REST API that connects to a client that controls the machine through an OPC-UA server connection and stores relevant data in a database.

3 Solutions



Figur 1: System drawing

Our distributed system consists of five sub-systems, where we are writing three of them.

4 OPC-UA Client

The OPC-UA client is responsible for communicating with the brewing machine via the OPC-UA server. This is needed in order to send and receive data via commands.

5 Website

The website user interface is where the client will be able to interface with our system.

6 REST API

The REST API functions primarily as a gateway in this design, in order for the front-end to receive data via fetch calls in JavaScript it needs to talk with something that speaks HTTP and preferably delivers data in JSON.

7 Objectives

The group wants to host the REST API and Website on a Linux based server on a fully-qualified domain name using the container technology Docker which should be configured via Docker Compose. Furthermore the group aims to setup a continuous integration pipeline for development and continuous delivery via Watchtower.

7.1 Initial Requirement Analysis

7.2 Summary of requirements

The groups proposed solution will adhere to the requirements given by the brewery Refslevbæk Bryghus A/S.
The 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 tract 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 of the produced batch. 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 timidity over the production time

The MES/SCADA 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 ISA88[1]213$Part1PhysicalHierarchymodel.Thesystemm$

7.3 List of requirements

ID	Name	Description
R01	Control production line	Start/stop production line
R02	Monitor production	Monitor production (collect data and store said data)
R03	Administer batches	Keep track of batches (batch ID)
R04	Store batch info	Collect various data associated with current batch number from machine
R05	Batch ID	Collect various data associated with current batch number from machine
R06	Live data	Monitor and display live relevant data from the machine
R07	Batch report	Produce a batch report (PDF/dashboard style format)
R08	Documentation	Documentation must contain an illustration that defines the different components in the setup in relation to the ISA88[1]$213 Part 1 Physical Hierarchy model$
R09	Visualization	Visualization that can be accessed and used to display the production data
R10	OEE	Collect necessary data from the machine and calculate the OEE. OEE must be available to be displayed by the system
R11	Estimate error function	Estimate the error function associated with the products
R12	Optimal Production speed	Estimate the optimal production speed for each product type

Tabel 1: List of requirements

7.4 Prioritization of requirements

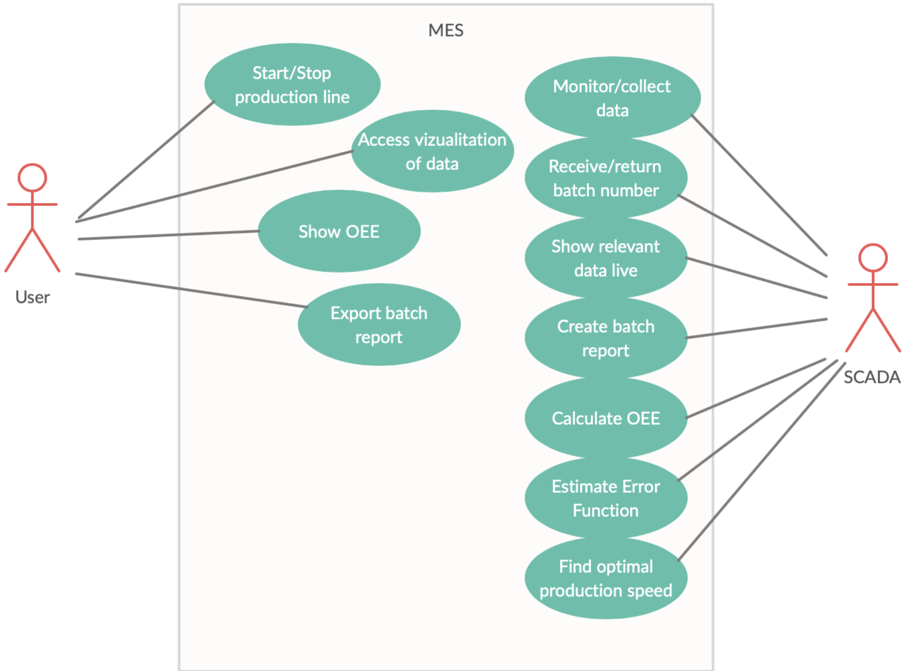
The group has decided that at the current state, every requirement is a must have. A further prioritization of requirements will occur, when we split the requirements into issues.

7.5 Use Case Diagram

7.6 Supplementary Requirements

FURPS	Demands
Functionality	
Usability	Documentation on usage of the REST API
Reliability	On server reboot, the application will automatically restart
Performance	Max response time (API: 400 ms)
Supportability	Minimum browser versions

Tabel 2: Supplementary Requirements



Figur 2: Use Case Diagram

8 Stakeholders

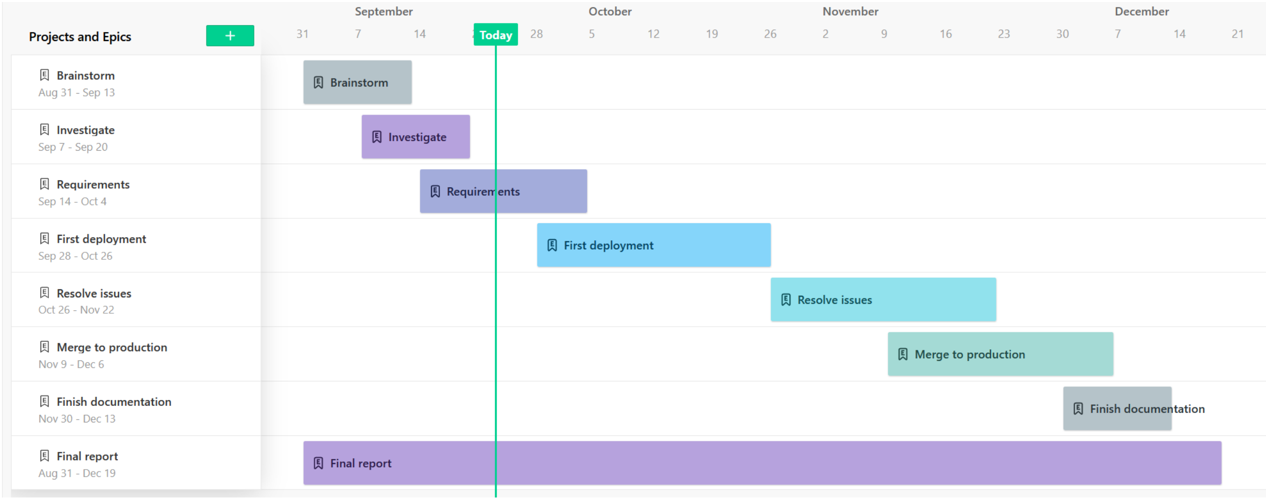
For this project the group does not have any external stakeholders, which is a problem when developing using SCRUM, since this role is usually filled by a Product Owner role (abbreviated to PO from here on out). The PO should under normal circumstances be one from the customers firm, and their job is to choose which features (user stories) that they would like developed next. Since such a person does not exist for this project, the group have instead pinpointed Kristian Nymann Jakobsen to fulfill this role.

9 Project Organisation

In this project, work is distributed from planning meetings. These planning meetings take place at the beginning of each sprint, where the workload is estimated and distributed across the team members. Kristian Nymann Jakobsen was chosen to be the Product Owner, so he oversees the "what", with a focus on value, time to market etc. Kenneth Munk Christiansen was chosen to be Scrum Master, so he must ensure that the Scrum framework is understood and is used correctly throughout this project. Like the rest of the group, they are also a part of the Development Team.

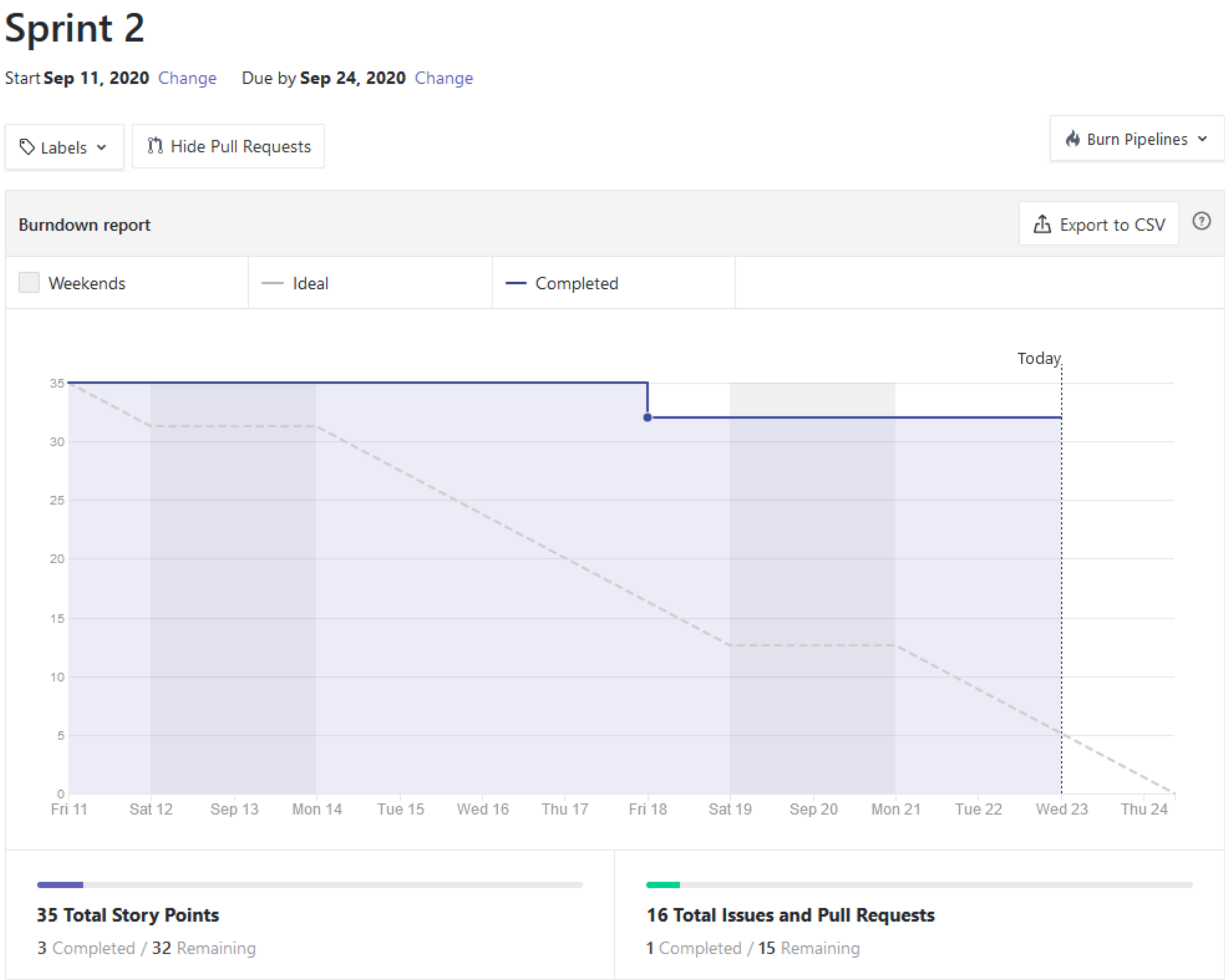
10 Project Plan

To be sure that it is feasible to complete the project within the designated time frame a project plan has been made with inspiration from the project plan supplied by the supervisor.
In this it is shown when the different milestones must be completed to succeed with the project. As mentioned above, sprints with a duration of two weeks will be used throughout this project. Each sprint consists of issues from the product backlog and is chosen at the beginning of each



Figur 3: project plan

sprint, as de-scribed in section Methods. To keep track of these sprints, a burn down chart will be made, as seen below.



Figur 4: sprint

This ensures the group that each sprint is successfully completed, and if not, it is easy to see where it went wrong, and the remaining issues can be transferred to the next sprint.

11 Risk

The group foresees three risks with varying impact levels.

11.1 Covid-19

Assessment	**Impact**	**Critical**
High	High	Yes

Tabel 3: Covid-19

With regulations concerning social distancing and the risk of being infected with Covid-19, most work will take place from home. To avoid complications, expectations to finish delegated work to each group member will be raised. Each member is also expected to follow the lectures. The supervisor will be available for contact via e-mail, if questions should arise.

11.2 Schedule

Assessment	**Impact**	**Critical**
High	High	Yes

Tabel 4: Schedule

If the group falls behind schedule, the delegated work tasks will be evaluated.

11.3 Lost team member

Assessment	**Impact**	**Critical**
Medium	Low	Yes

Tabel 5: Lost team member

Since the group has already lost a member, the group is currently undermanned. To stay on top of the semester project, expectations to finish delegated work to each member will be raised. Each member is also expected to follow the lectures.

12 Milestones

12.1 About milestones

This is our milestones and activities. **Activities** will include scrum planning and meeting. It will also show some key activities from the school, that are mandatory and at last it will also show when the project is need to be handed in. **Milestones** is the overall structure of the project. Milestone shows the different phases we are going through.

Phase	Activities	start date	end date	week
Brainstorm	Scrum planning (1)	28-08-20		35
	kickoff	01-09-20		36
Investigate	Scrum meeting	04-09-20		37
Requirements	Scrum planning (2)	11-09-20		38
	Scrum meeting	18-09-20		39
First deployment	Scrum planning (3)	25-09-20		40
	Team leader meeting	25-09-20		
	Project draft	02-10-20		
	Peer feedback start	05-10-20	09-10-20	41
	Scrum planning (4)	09-10-20		
	Final project foundation	18-10-20		42
	Scrum planning (5)	23-10-20		43
	Team leader meeting	09-10-20		
	Project week	18-10-20	24-10-20	
Resolve issues	Scrum meeting	30-10-20		44
	Code review	30-10-20		
	Scrum planning (6)	06-11-20		45
	Scrum meeting	13-11-20		46
Merge to production	Scrum planning (7)	20-11-20		47
	Scrum meeting	27-11-20		48
Finish documentation	Scrum planning (8)	04-12-20		49
	Scrum meeting	11-12-20		50
	Scrum meeting	18-11-20		51
	Final report	02-12-20		

Tabel 6: Milestones

13 Tentativ outline

The estimated outline of the project report is as follows;

I Cover(title, information, signatures)

II Summary

III Preface

IV Table of Contents

V Editorial(contribution table)

VI List of figures

13.1 Main report

1 Introduction

   (a) Motivation?
   (b) Problem formulation

2 Background

   (a) Review of relevant literature and other background information

3 Problem analysis

   (a) Use-case analysis
   (b) Use-case realization

4 Theory and Methods

   (a) Theory
   (b) Methods

5 Requirements

   (a) Overall requirements specification
   (b) Selected detailed requirements
   (c) Detailed use-cases
   (d) Functional and non-function requirements
   (e) The physical setup(brewing machine)
   (f) Description of the simulator(mathematical??)

6 Architecture(System architecture)

7 Design

   (a) Description of specific parts of the system(what's important and interesting)

8 Implementation(description of technically complicated parts of the system)

9 Verification and validation(verify, simulate and test that the implemented system fulfils the requirements)

10 Evaluation(Evaluation of the developed product from a user/customer point of view)

11 Conclusion

12 References

13 Appendix(all technical details that are not essential to understanding the report)(bilag)