University of South-Eastern Norway

FM4017 Project

Title: **Beer Production on a Pilot Plant Using the Emerson DeltaV Control System**

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External partner: Rune Andersen, Emerson at Porsgrunn.

Task background:

Beer brewing has a long tradition in Norway. The process consists of several steps, and these steps determine how the characteristic of the end product. Apart from raw materials and cleanliness, accuracy and repeatability of the process conditions are very important to create a good beer.

DeltaV is a leading industrial automation system with many options for monitoring and controlling processes. There is a great practical learning potential and professional curriculum value on developing and testing automation strategies using the DeltaV management system.

At USN we have installed a full pilot-size plant for the production of beer. The plant equipment perform the different unit operations required, including heating, fast cooling, solids separation, material transport among equipment units, and fermentation.

For this project, we require a team conformed by two students from industrial automation (IIA), and two students from process engineering (PT, EET, EPE). The objective of the project is to do all the process analysis, research, and control implementation to produce two batches of beer, a type ale beer (fermented at room temperature), and a lager type beer (fermented at a carefully controlled low temperature). The project requires a multidisciplinary team, a condition that is commonly found in most large projects in industry.

Detailed task description:

- Prepare a preliminary project activities schedule plan.
- Prepare a detailed description of the beer process using the existing pilot plant as a reference
- Identify the main process variables that should be controlled.
- Prepare a list detailing all the inputs and outputs of the system.
- Prepare a layout/topology of the control system.
- Implement the control algorithms for the production of beer using the DeltaV.
- Implement the control sequences for the cleaning of the pilot plant using the Delta V.
- Test and tune the controllers on the pilot plant using only water.
- Plan the production of a batch (60 liters) of type «ale» beer.
- Process the batch of «ale» beer. Clean the pilot plant after production.
- Plan the production of a «lager» beer.

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- Process the «lager» beer. Clean the pilot plant after production.
- Estimate the cost for energy used on the production of both types of beer.
- Write a detailed report of the project. The report should contain four parts: a general description of the beer production process, a detailed description of the pilot plant and the control system for the production of beer using DeltaV, a detailed description of the control system for the cleaning of the pilot plant using DeltaV, and a description of the production of the two types of beer, including reports of its characteristics (initial and final density, final content of alcohol) and estimated cost of production, including an estimate for the cost of the energy used.

Student category:

Two students of IIA, two students of PT, EET or EPE.

Practical arrangements:

The project will be carried at USN campus Porsgrunn, using the new beer lab pilot plant on the basement of the B building. The students will have supervisors and training for the operation of the pilot plant, the instrumentation part, and the control part. Additional training on the DeltaV system can be provided by Emerson. At least one of the supervisors should be present in the beer lab during the plant operation. The project requires that the students can be present in Porsgrunn during the lab tests, beer production, and plant cleaning process.

Signatures:

Supervisor (date and signature):

Students (date and signature):