

Low-Cost Monitoring and Control of Fermentation Processes for Next-Generation Low-Alcohol Beverages

Candidates	: TBD
Duration	: Fall Semester 2026-2027
Report	: 11.12.2026, 23:59
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Expert / Company	:
Abbreviation	: LoAlcFerm
Key Words	: low- and no-alcohol beverages; fermentation monitoring; low-cost sensors; wine fermentation

1. Description

The market for low- and no-alcohol beverages is growing, driven by changing consumer preferences and increasing interest in innovative and locally produced alternatives to traditional alcoholic beverages. Wine is a particularly relevant example, but similar challenges arise in beverages such as cider, mead, kombucha, and kefir. Small and medium-sized producers often rely on laboratory analyses and practical experience to monitor fermentation, while sophisticated online monitoring systems can be too expensive or complex for smaller-scale production.

This interdisciplinary project aims to investigate how accessible, low-cost monitoring technologies can improve the control and consistency of fermentation processes, with a particular focus on low- and no-alcohol wine. The project will examine current approaches to fermentation monitoring, identify key parameters, and evaluate promising low-cost technologies for monitoring CO₂, O₂, pH, turbidity, temperature, specific gravity, and other relevant indicators. Particular attention will be given to analytical performance, cost, robustness, ease of use, and potential for implementation.

The project will address the biotechnological aspects of fermentation, analytical and process-monitoring technologies, and their application to wine and other fermented beverages. It will also explore how monitoring data can be used to detect fermentation deviations and support practical process-control decisions.

The main outcome will be a research project proposal based on the HES-SO *Projet libre* format. The proposal will include a state-of-the-art review, identification of research gaps, research questions and hypotheses, work packages, experimental methodology, timeline, resources, and expected outcomes. Engagement with local wineries and other beverage producers will provide insight into current practices, challenges, and the potential interest in accessible monitoring solutions.

2. Objectives

1. Assess current fermentation monitoring and control strategies

Review existing approaches for monitoring low- and no-alcohol fermentations, with a focus on wine and selected emerging beverages, and identify key parameters and current limitations.

2. Identify promising low-cost monitoring technologies

Evaluate accessible sensors and analytical methods for parameters such as CO₂, O₂, pH, turbidity, temperature, specific gravity, and others, considering performance, cost, and ease of implementation.

3. Develop concepts for fermentation monitoring and control

Investigate how low-cost measurements could be combined to follow fermentation progress, detect deviations, and support practical process-control decisions.

4. Assess producer needs and market potential

Contact local wineries and other beverage producers to understand current practices, monitoring challenges, technological needs, and interest in adopting low-cost monitoring solutions.

5. Develop an interdisciplinary research project proposal

Integrate the findings into a research proposal addressing the identified gaps, including research questions, methodology, work packages, timeline, resources, and expected outcomes.

3. Remarks

Templates for the report and additional information will be provided by the advisor.

A draft report must be submitted on 10.11.2026 and will be discussed during an online session on 17.11.2026.

On the due date of the report, the following documents have to be provided by the candidates:

- Report in electronic form (Word and PDF) to the advisor and co-advisors
- The report can be written in English, French or German and should be limited to 20 pages in length (excluding appendices).

4. Evaluation

The final grade of the module will take into account the report (40%), the defense (30%) and an individual interview (30%).

The report will be evaluated according to the following criteria:

	Very good	Good	Slightly insufficient	Significantly insufficient
Context and objectives	Permanent vision of the project context, mastery of all objectives	Sufficient understanding of the context and main objectives of the project, with occasional refocusing required	Insufficient understanding of context and objectives, regular refocusing necessary	Constant reframing of context and objectives or ignoring context and objectives
State of the art	Relevant selection of existing resources, clear summary, clear positioning of the project	Selection of relevant resources, partial summary, positioning of the project presented but not very in-depth	Selection of irrelevant resources, unclear or non-existent project summary and positioning	Selection of irrelevant resources or missing state of the art
Research methodology	Appropriate and well-described research methods. The innovation sought will enable proven advances to be made	The research methods have minor shortcomings which impact the clarity of the research proposal. By large, the innovation actions will allow to fulfill the goals of the project.	The research methods have major shortcomings which significantly impact the clarity of the research proposal. By large, relevant parts of the proposal objectives will not be fulfilled.	Research methods are inappropriate or incomprehensible. The innovation sought will not lead to proven advances
Planification	Tasks and deliverables broken down and planned in a relevant and autonomous manner, realistic planning including resources and costs	Tasks and deliverables cut out and planned in a relevant way after a few modifications	Numerous corrections needed to arrive at a definition of tasks and deliverables and a workable schedule	Unworkable breakdown and planning despite multiple iterations
Clarity and legibility	Clean, concise writing, precise vocabulary, high-quality illustrations described in the text, attractive layout	Acceptable writing (a few spelling mistakes), generally appropriate vocabulary, mostly legible illustrations	Several spelling mistakes per page, often insufficient vocabulary, poor quality or inappropriate illustrations	Spellchecker not used, inappropriate vocabulary, poor quality/inappropriate illustrations, sloppy layout

The defense will be evaluated according to the following criteria:

	Very good	Good	Slightly insufficient	Significantly insufficient
Structured presentation and ability to summarise (15%)	Introduction of context, clear structure, clear, well-argued summary	Adequate structure, some awkward transitions, partial or unargued summary	Unconvincing structure, missing transitions, unconvincing synthesis	Context not introduced, lack of main theme and summary
Presentation materials (15%)	Clean, error-free and legible material, good linkage between presentation and material content	Appropriate support material, usually error-free and legible, used for the presentation	Loaded and illegible media or no control over media content	Overloaded and illegible media and no control over media content
Posture and oral expression (15%)	Open posture, captures the listener's attention, good elocution, appropriate and specific vocabulary	Open posture, lack of dynamism, adequate elocution, mostly appropriate vocabulary	Closed posture, limited contact with the public, limited and/or inappropriate vocabulary, poorly comprehensible oral expression	Closed posture with no contact with the audience, incomprehensible or inaudible speech
Technical depth of the presentation (15%)	Fully convinced of the quality and depth of the work carried out and of its original contribution to TM	Impression that the work carried out has an appropriate technical depth for a TM	The presentation does not allow us to assess the quality and depth of the work carried out	Impression of surface work, no new technical elements linked to TM, the presentation is a smokescreen
Presentation management (15%)	Time limit respected, prepared slides were all dealt with in the same level of detail, self-assessment included in 30 min.	Slight overrun (3 min max) or necessary acceleration during the presentation with a different level of detail for the last slides, self-assessment included in the 33 min.	Overrun of more than 3 minutes or necessary acceleration with more than 3 slides not dealt with or no self-assessment	Overrun of more than 6 minutes or necessary acceleration with more than 6 slides that are not processed or no reaction to the supervisor's warning.
Interacting with listeners and answering questions (25%)	Constructive attitude in discussions, clear answers in line with the questions asked	Constructive attitude in the discussion, imprecise answers in line with the questions	Lack of commitment to the discussion, answers not in phase with the questions	Defensive and/or negative attitude in the exchange, irrelevant responses (avoidance, deflection)

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XX.XX.2025, Sion

Advisor

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