TECHNISCHE UNIVERSITÄT
BERGAKADEMIE FREIBERG
Die Ressourcenuniversität. Seit 1765.

MSELab

Thesis offer

Temperature Measurement Extension for an Ultrasonic Hydrogen-Mixture Analyzer

Type of Thesis: MA/BA/SA/Diplom

Suitable for: Applied Computer Science, Robotics, Engineering

Motivation & Background:
In the coming years hydrogen is supposed to replace natural gas in a multitude of industrial processes, energy production and chemical manufacturing in order to reduce their carbon dioxide emissions. This transition will be achieved by gradually adding hydrogen to the existing natural gas infrastructure. The safe operation of all connected facilities requires knowledge of the mixing ratio of natural gas and hydrogen at the processing site.
Ultrasonic Time-of-Flight measurements are a common tool to investigate gas flows. We expanded it and built a functioning measurement system for hydrogen concentration (UHCS) capable of generating control input to safely operate high-power furnaces. You will improve this system and add functionality required for industrial and scientific use cases.

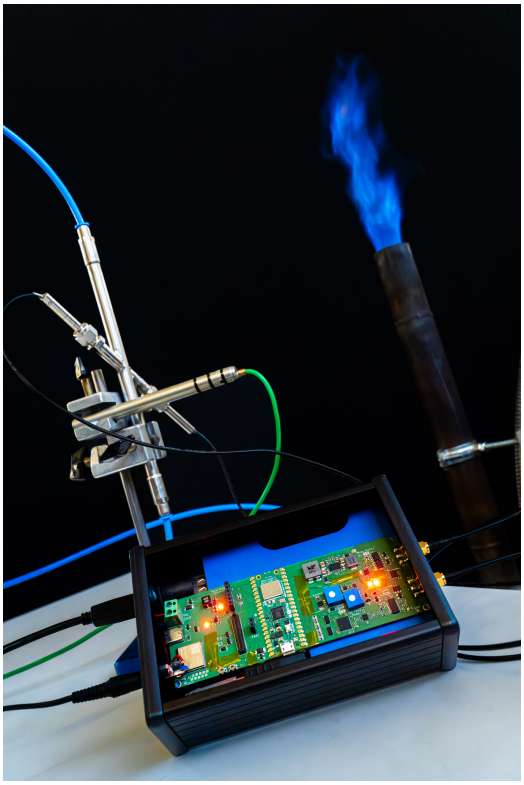

Figure 1: UHCS in Action! Photo: Andreas Hiekel

Goals & Objectives:
Since the speed of sound in gas mixtures is temperature-dependent, accurate temperature compensation is essential for reliable composition measurements. You will research, design, build and evaluate a temperature measurement extension to the UHCS system, expanding its applicability for further research. The project covers the complete research and development cycle of an embedded system in the field of measurement technology.

Milestones:
- Analyze the existing system and understand the applied measurement principle, perform test-measurements
- Derive specifications and research implementations of temperature measurement suitable for the application at hand
- Design a circuit to facilitate temperature measurement and integrate it into the existing system
- Build the extended system and validate it in a simple experiment

Character of the work:
10% Literature Research, 20% Metrological Analysis, 20% Circuit and PCB Design, 20% Firmware Development, 10% Hardware Assembly, 20% Validation

Supervision & Workflow:

- Regular **bi-weekly meetings** between student and supervisor to evaluate status and progress and identify need for support. Additional meetings can be arranged if required.
- Additionally, the supervisor is **reachable via Element Messenger** for support on smaller technical questions.
- Students are encouraged to give a **mid-term presentation** as a preparation for the final presentation of the thesis. This is an opportunity to discuss the results with a broader audience and get important feedback on the current state of the work.

Supervisor: Dipl.-Ing. Robert Kunz (Dr.-Ing. Jakob Sablowski)