

Topic for a mandatory internship / a diploma or academic thesis.

**Topic:** Development of a novel NDIR multi-gas sensor with a very high dynamic range.

**Objective:**

Conventional NDIR gas meters measure multiple gases simultaneously with a multi-channel detector but suffer from significant drawbacks. These include the fixed absorption path or cuvette length for all spectral channels and the distribution of radiation intensity onto individual detector elements. For example, in the case of a 4-channel detector, only 25% of the incident radiation intensity per detector element is available for signal generation. Due to construction limitations, it is usually much less than 10%. However, a constant absorption path length for all spectral channels restricts the measuring range, dynamic range, and detection limit of the multi-gas sensor.

This project aims to investigate a patented design of a novel NDIR multi-gas sensor that overcomes these limitations. A functional sample and CAD data are available as a basis. The objective is to design and build a prototype of this novel NDIR multi-gas sensor for a given application. The focus will be on metrological characterization and calibration with defined gases and gas mixtures, as well as the examination of interfering influences and cross-sensitivities to estimate measurement inaccuracies.

The project consists of the following subtasks:

- Conducting a literature study and acquiring knowledge in the field of infrared metrology and NDIR gas analysis.
- Planning and designing a multi-gas sensor for a given application, including the selection of suitable infrared detectors, path lengths, and construction in CAD, as well as the optimization of the design.
- Building the multi-gas sensor and conducting metrological characterization, including the investigation of interfering influences and cross-sensitivities.
- Validating the measurement setup and estimating measurement inaccuracies.
- Analyzing and discussing the results.

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