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Institut für Technische Informatik
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Semester Thesis:

Design of a Self-Calibrating Air Quality Sensor

Task Description: In the last few years low-cost gas sensors have been become popular means to monitor air quality, like the MICS-5524 by SGX Sensortech[1] shown in Fig. 1. These small and inexpensive sensors are able to sense different major air pollutants, such as ozone (O_3) in outdoor environments or volatile organic compounds (VOC) in indoor environments.

Due to their simplistic operation low-cost air quality sensors need to be calibrated, i.e. transform the raw sensor measurement into a pollutant concentration. One popular method to calibrate a sensor is to expose it to controlled pollution concentrations and relate the sensor response to the actual pollution levels by fitting a calibration curve. This approach is generally conducted in a laboratory and requires a pollution source (e.g. a gas bottle filled with the desired pollutant), a source controller, an air-tight chamber and the sensor-under-test. While this laboratory setup enables quick calibration procedures it also is in general expensive and bulky.

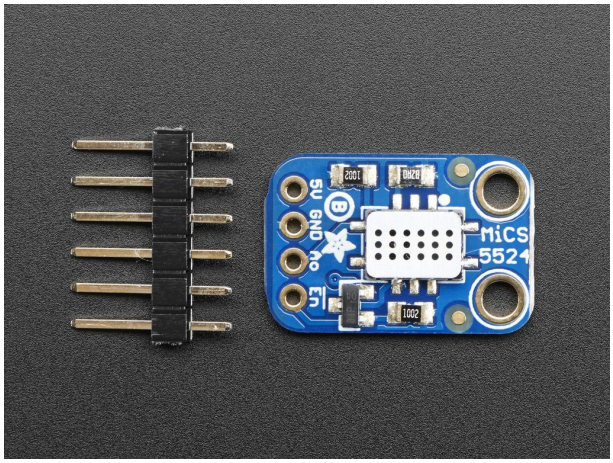

Figure 1: Breakout board of a popular metaloxide air quality sensor.

Recently different compact and cheap pollutant generators, such as the H_2 generator cell by Varta Microbatteries[2], have become commercially available. These generators are able to produce small concentrations of gases. The concentrations can be controlled with a dedicated controller, e.g. a variable load resistor. Due to their small and compact size (i.e. size of a coin cell), they could potentially be integrated into compact air quality monitoring devices and offer a possibility to frequently re-calibrate gas sensors while being deployed. In this thesis we want to investigate the potential of these generators for the calibration of low-cost sensors. This involves the following coarse tasks for you:

- Getting yourself familiar with related work.
- Design of a prototype consisting of: *(1)* a gas generator cell, *(2)* a generator control circuit, *(3)* one or multiple low-cost gas sensors and *(4)* and a data acquisition unit.
- Conducting an elaborate evaluation to investigate the feasibility of your prototype, i.e. investigating repeatability, accuracy and resolution of the produced gas concentrations.

Requirements: Basic circuitry and programming skills. Interest in planning and conducting technical experiments.

Interested? Please have a look at http://www.tec.ethz.ch/research.html and contact us for more details!

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[1] https://www.adafruit.com/product/3199
[2] https://www.varta-microbattery.com/produkte/wasserstofferzeugerzellen/?lang=en