

Multi Gas Sensor

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1 System description

The system is a sensor which performs exact measurement of climate parameters, such as temperature, CO₂ and humidity in connection with ventilation in buildings e.g stables. Furthermore, the emission of environmentally harmful gases, the so-called NO_x and SO_x, is measured directly in, for example, chimneys on ships.

The sensor system (see fig.1) is based on infrared absorption spectroscopy. Electromagnetic radiation emitted by an IR source is absorbed by specific gasses at specific wavelengths. The resulting change of IR reaching the detector correlates to the gas concentration.

For each gas two wavelengths are measured simultaneously, one which absorbs the gas and one which don't. An intrinsic correlation between the reference and the suspect channel in the measurement is established and the concentration of the gas can be calculated.

The IR source is modulated with a PWM generated signal to be able to filter out electromagnetic radiation noise.

The output from the system is either a measurement report sent via UART (or other network connection) or an industrial standard analog signal (4-20mA / 0-10V).

The output is updated every 10sec.

The system is powered with 10-24VDC, and the ADC sampling for gas channels are $f_{sg}=15\text{kHz}/24\text{bit}$ and ADC sampling temperature is $f_{st}=267\text{kHz}/12\text{bit}$.

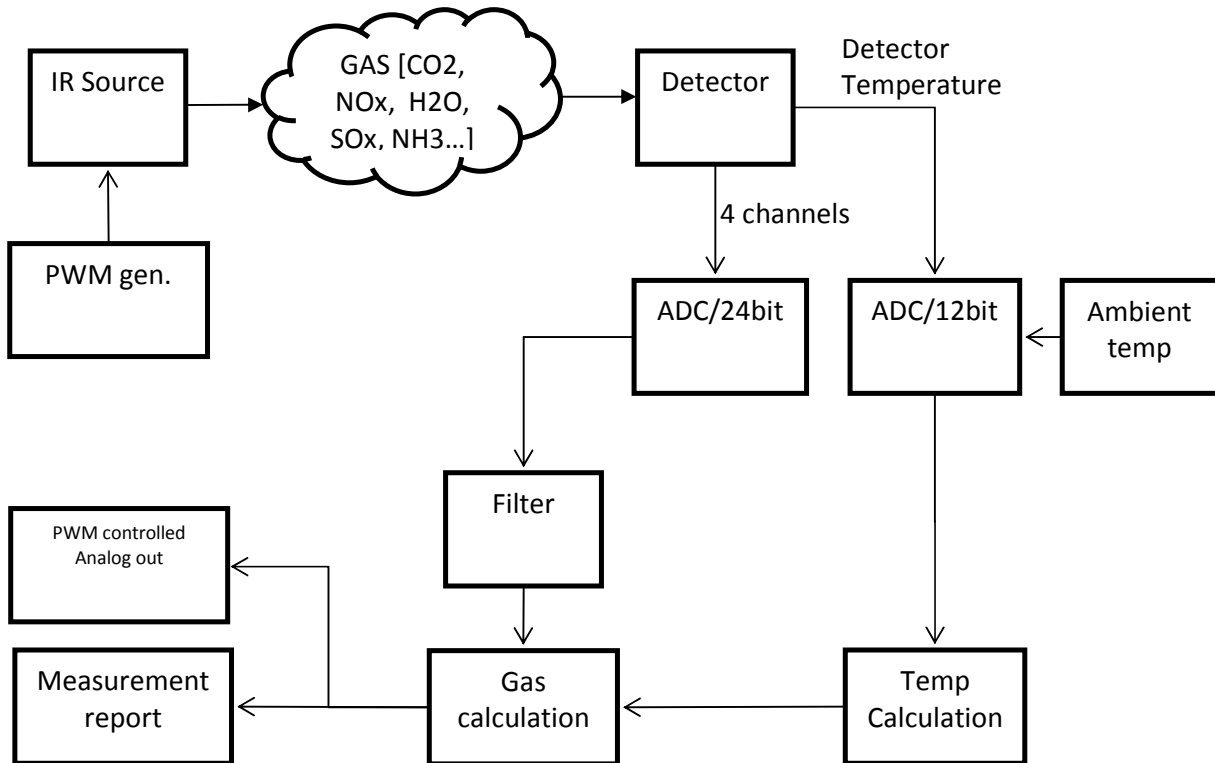


Figure 1 Sensor system block diagram

Functional Requirements

- Response time shall be less than 2 seconds.
- It shall be able to measure 2 different gasses + ambient temperature simultaneously.
- Remote filter and temperature calibration shall be possible.
- The system shall be flexible so additional gas channels can be added.

2 Challenges

At the moment the sensor measures CO₂ and H₂O with fairly simple algorithms, going to measure NO_x and NH₃ gasses requires more heavy processing algorithms and at the same time there is a need to update every 2 seconds instead of 10 seconds.

There is a future wish that the sensor should be used as battery driven device in a wireless network. This will require low power consumption.