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New development of a small customizable system for the measurement of volcanic gas concentrations with LTE data transfer

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Volcanic areas frequently have diffuse gas emission of CO₂, SO₂, H₂S and even more. Normally these diffuse emissions do not vary only by time but also with location. Therefore, the spatial variation of concentrations cannot be monitored with one measurement system alone. On the other hand, the strength of gaseous volcanic emissions is often correlated with volcanic activity and can potentially endanger population in the vicinity.

For this reason, we developed a light new low-cost unit for the parallel measurement of various gases like CO₂, SO₂ and H₂S, which has the remarkable advantage of being able to transmit the measured data and GPS position with LTE to a remote server. Moreover, it can operate in an unattended way for days or even weeks, depending on the customizable operation modus of the unit and the capacity of the attached rechargeable battery. A solar-powered version is currently in development. The evaluation of the received data can be performed online on the server and the results are displayed continuously. The software is programmed by us in a way that alarms can be started in case that concentrations exceed predefined alarm thresholds also via email.

The electronic hardware unit is designed in a way that it can be equipped with low-cost NDIR sensors, electrochemical sensors or photoacoustic sensors (e.g. for CO₂: Sensirion SCD41). There are 4 analog ports (selectable voltage or current).

The operation procedure of the sensors electronics is customizable as well: The operation can be changed from continuous running to following mode:

- Measurement period,
- low power sleep period,
- sensor warm up-period,
- measurement period etc.

The length of all these time periods of the operation procedure can be varied depending on the measurement needs. That means for long runtime of the measurement a long sleeping time between the measurement periods can be chosen. On the other hand, if low power consumption and long runtime are not necessary, short sleeping periods or even the continuous running mode can be chosen. The operation configuration, e.g. sleeping time, can be changed by remote

firmware update.