MASTER‘S THESIS

Topic:

When Bits Smell – Characterization of an Olfactory Communication System

Motivation:

In an information driven society the development of intelligent and innovative ways to transmit information is essential. Besides common methods, such as acoustic waves (e.g., underwater communications) or electromagnetic waves (e.g., WLAN, 5/6G.), information can also be sent through spreading different (aromatic) substances.

The aim of this master’s thesis is the characterization of a novel olfactory communication system, which is currently being developed at our institutes (cf. Fig. 1). The system uses a vapor source (ultrasonic atomizer), a pipe and a quartz crystal microbalance (QCM[1]) detector acting as transmitter, channel, and receiver, respectively. In particular, the vapor source generates a fine mist of a certain substance which propagates through a pipe assisted by an air flow generated by a fan. At the receiver the QCM detector recognizes different mass loadings via the change of the resonance frequency. The resonance frequency depends on the liquid properties, such as density, viscosity, and volatility. This means that the sensor signal corresponds to a characteristic *fingerprint* for each (aromatic) substance. This enables on the one hand the identification of individual substances that are successively transmitted and on the other hand the identification of multiple substances in a single vapor burst. This property can be exploited to realize an efficient information transmission. For example, the transmission of two bits may be realized as follows: **00** – no mass loading, **01** – only substance *X* detected, **10** – only substance *Y* detected, ***11*** – 50% substance *X* + 50% substance *Y* detected.

Figure 1 *Setup of in-house olfactory communication system*

Tasks:

- Investigation of the *fingerprint* of different (aromatic) substances
- Mathematical modelling of the olfactory communication system with a focus on the QCM detector
- Experimental validation of the theoretical model

Contact:

Dr. Werner Haselmayr (NTHFS, DW 6380, werner.haselmayr@jku.at)
DI Nikolaus Doppelhammer (IME, DW 6274, nikolaus.doppelhammer@jku.at)

[1] https://iopscience.iop.org/article/10.1088/1361-6501/ac2c4a/pdf