PhD at Infineon Austria in advanced Multichannel Ultrasound Processing

Infineon (Austria) is developing MEMS-Microphones and ASICs for the most important players in the global smartphone market and other applications (Smart Speaker, TWS, ..). For potential future application we would like to evaluate the opportunities of our "best-in-class" microphones together with advanced "RADAR-like" algorithms for new applications and investigate future ASIC requirements. A potential starting point is the publication on "Using smart speakers to contactlessly monitor heart rhythms" Wang2021. Within this PhD-Thesis a systematic investigation of the opportunities of advanced signal processing in dedicated hardware together with the latest generation of MEMS microphones and more sophisticated algorithms and hardware will be evaluated, including a definition of future ASIC concepts.

- Understanding, simulation and setup of a comparable demonstrator to Wang2021 with superior best-in-class hardware, e.g. 80 dB SNR MEMS Microphones compared to 65 dB devices in and advanced hardware.

- Evaluation of different Microcontroller/hardware concepts for this application. Infineon is offering ARM-based µC controllers PSOC6 with audio codecs, the evaluation of existing audiocodes for potential future ASIC architectures will be one part of the PhD.

- For automotive applications Infineon is offering the Mulitcore Aurix Safety controller including the Generic Timing Module (GTM), a huge number of parallal ADC for synchronous ampling and multichannel signal processing in high-performance RADAR and MIMO applications. A study on the signal processing of the multiple Ultrasonic channels should be integrated in this architecture including a concept for dedicated hardware without the automotive overhead for safety and multicore applications.

- There is a lack on good lectures on state-of-the-art signal RF and Audio signal processing, it would be an important part of the PhD to transform the scientific results in a lecture-series, ideally with a demoboard with a Cypress PSOC or the Aurix Shieldbuddy AurixShieldbuddy.

- Definition of ASIC-concepts future applications in that field with a high focus on Ultrasound Multichannel processing, a very inspiring actual publication is Rothberg2021.

This is only a rough outline matched to the application of Nikola Cvetkovic and the Institute of Prof. Vladimir Rajovic. If there are any suggestions or questions please feel free to contact via siegfried.krainer@infineon.com or +43 676 8205 6188.

Best regards
Siegfried Krainer

Bibliography

[1] INFINEON: *Infineon PSOC6 MCU Inter-IC Sound Example*

[2] INFINEON: *ShieldBuddy TC375 - Infinite possibilities for embedded applications*

[3] ROTHBERG, J. M. ; RALSTON, T. S. ; ROTHBERG, A. G. ; MARTIN, J. ; ZAHORIAN, J. S. ; ALIE, S. A. ; SANCHEZ, N. J. ; CHEN, K. ; CHEN, C. ; THIELE, K. ; GROSJEAN, D. ; YANG, J. ; BAO, L. ; SCHNEIDER, R. ; SCHAETZ, S. ; MEYER, C. ; NEBEN, A. ; RYAN, B. ; PETRUS, J. R. ; LUTSKY, J. ; MCMAHILL, D. ; CORTEVILLE, G. ; HAGEMAN, M. R. ; MILLER, L. ; FIFE, K. G.: Ultrasound-on-chip platform for medical imaging, analysis, and collective intelligence. In: *Proceedings of the National Academy of Sciences* 118 (2021), Nr. 27, e2019339118. `http://dx.doi.org/10.1073/pnas.2019339118`. – DOI 10.1073/pnas.2019339118

[4] WANG, A. ; NGUYEN, D. ; SRIDHAR, A. R. ; GOLLAKOTA, S. : Using smart speakers to contactlessly monitor heart rhythms. In: *Nature Commun Biol* 4 (2021), S. 130–139. – ISSN 2399–3642