Open Thesis / Project
Low-Latency and High-Fidelity Wireless Audio using UWB Technology

Thesis Type
Master Project / Master Thesis

Motivation
In today's rapidly evolving technological landscape, audio plays a crucial role in enhancing user experiences across various domains, from entertainment to communication and beyond. The demand for low-latency and high-fidelity audio has never been higher, as users increasingly expect seamless, immersive, and crystal-clear sound. Especially technologies such as Bluetooth Low Energy (i.e., Bluetooth LE Audio)[1] and ultra-wideband (UWB)[2] are at the forefront of addressing these requirements, promising a future where audio experiences are more immersive, synchronized, and personalized than ever before. As these technologies continue to evolve and integrate into various ecosystems (including high-end smartphones, tablets, and modern vehicles), they hold immense potential for revolutionizing the audio industry and improve our daily interactions with technology.

Within this context, we aim to study and quantify the performance offered by UWB technology in terms of suitability for low-latency and high-fidelity audio applications, in order to understand which advantages and disadvantages it offers compared to classical solutions based on Bluetooth Low Energy.

Goals and Tasks
Within this context, students can explore several directions and perform different tasks, such as:

- Understand what state-of-the-art technologies such as Bluetooth LE Audio and UWB offer to applications in the audio domain;
- Develop a prototype of an UWB headset running on a constrained IoT device (e.g., the `nRF5340-DK`);
- Investigate the audio performance of the developed prototype based on several audio codecs as well as the suitability for real-world applications, bridging the gap between theory and practice.

Target Group

- Students of ICE/Telematics;
- Students of Computer Science;
- Students of Electrical/Audio Engineering.

Required Prior Knowledge

- Interest in (low-power) wireless technologies;
- Experience with embedded system development in C (e.g., using the Zephyr RTOS).

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