Open Thesis / Project

Maximizing the Coexistence of Co-Located UWB Devices

Thesis Type

Master Project / Master Thesis

Motivation

Ultra-wideband (UWB) has emerged as one of the most popular radio technologies for building location-aware IoT applications. Its high bandwidth allows in fact for a high timing resolution of the received signal, which leads to excellent ranging capabilities and enables distance measurements with sub-decimetre precision. Moreover, UWB radios can be embedded in tiny tags that can be powered by battery for an extended time. This makes UWB devices highly suitable for applications such as drone-swarm localization, indoor navigation, social distance-tracking, and secure access systems.

Unfortunately, UWB devices can operate only on a few frequency channels and commonly lack clear channel assessment capabilities: this makes it difficult to support several devices operating concurrently within a single network, or to avoid coexistence issues with other UWB-based systems operating in close proximity. The IEEE 802.15.4 standard proposes the use of complex channels (i.e., diverse combinations of frequency channels and preamble codes) to enable multiple orthogonal transmissions, but it remains to be shown how well concurrent transmissions over different complex channels perform on the new-generation UWB transceivers compliant to the IEEE 802.15.4z standard.

Goals and Tasks

Within this context, the student can explore several directions and perform different tasks, such as:

- Get familiar with our previous studies on how well concurrent transmissions over different complex channels perform on the old-generation UWB radios compliant to the IEEE 802.15.4a standard (e.g., Qorvo DW1000 devices);
- Get hands-on experience on the functionality of the next-generation UWB transceivers (e.g., Qorvo DW3000 devices) using modern embedded operating systems such as Contiki-NG or Zephyr;
- Perform experimental studies using the new-generation UWB transceivers and find concrete solutions improving the coexistence of multiple devices operating concurrently in the same area.

Target Group

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

Required Prior Knowledge

- Solid C programming skills;
- Experience with the programming of embedded devices and micro-controllers;
- Knowledge of wireless and localization systems is of advantage;
- Basic data analysis skills (e.g., Python or MatLab).

Contact Person

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