Open Thesis / Project / Paid Student Job

Centimetre-Accurate UWB Ranging in Non-Line-of-Sight Conditions

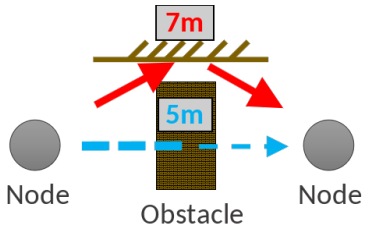
Note: *this work is suitable for a MSc project/thesis, and can also be performed as a* ***paid student job****.*

Motivation

Ultra-wideband (UWB) has recently become the technology of choice to create centimetre-accurate ranging and indoor positioning applications. Its market is growing at a fast pace and is expected to hit 2.7 billion USD by 2025, fueled by the introduction of UWB radios into high-end smartphones and modern vehicles, as well as by the increasing adoption of the technology in asset tracking, robot navigation, and assisted-living applications.

Under optimal conditions, i.e., when no obstacles block the direct line-of-sight (LOS) between two devices, UWB radios typically achieve centimetre-level accuracy. However, in non-line-of-sight (NLOS) conditions, the direct path between two UWB devices is either attenuated by partially-blocking obstacles (i.e., blue arrow in the figure), causing ranging errors of a few decimetres, or entirely blocked (i.e., red arrow in the figure), causing ranging errors up to a few metres. NLOS conditions hence strongly affect the performance of UWB ranging and indoor positioning in real-world settings and these need be detected and or corrected.

In our group, we have pioneered the first NLOS classification and error correction solution running directly on embedded low-power UWB devices [1].



[1] `https://tinyurl.com/2sczcpuc`

Goals and Tasks

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

- Experimenting with the new Qorvo DW3000 UWB radio to leverage the information provided by the extra antenna (bearing information and two channel impulse responses) to improve NLOS classification and error correction.
- Leveraging our framework "InSight" [1] to compare the performance of different approaches to detect NLOS conditions and correct NLOS-induced ranging errors.
- Creating their own approach to detect NLOS conditions and correct NLOS-induced ranging errors (e.g., by combining hardware indicators and/or machine learning techniques).
- Exploring ways to incorporate NLOS detection and error correction into existing indoor positioning solutions, so to improve their accuracy (e.g., by selecting only anchors in LOS).

Target Group

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

Required Prior Knowledge

- Basic knowledge of machine learning;
- Solid skills in Python and C programming;
- Experience with microcontrollers.

Contact Person

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