DEWINELabs

TU Graz

Open Thesis / Project

Towards Location-Aware BLE Devices

Thesis Type

Master Project / Master Thesis

Motivation

In recent years, the measurement of distance between two wireless devices has been a rapidly evolving area of research and development. Accurate and secure wireless distance measurements have the potential to enable new and innovative IoT applications, such as secure entry systems, safe industrial applications, and improved smart retail experiences. Traditionally, such measurements have either been highly inaccurate or required specialized hardware such as Ultra-Wideband (UWB) radios, which are not present in most IoT devices.

The recently-released Bluetooth 6.0 introduces *channel sounding*, a technique that enables distance estimation by analyzing phase measurements across multiple RF frequencies. This approach enables sub-meter accuracy and supports secure ranging, making it suitable for applications such as access control and asset tracking.

In this project/thesis, you will delve into BLE distance measurements on cutting-edge BLE devices. You will harness the power of BLE chips to implement and test novel approaches for distance measurements in various conditions, including challenging industrial environments. Your focus will not only be on improving accuracy, but also on ensuring robust and reliable performance over time and across diverse scenarios. You will improve BLE distance measurements, enhancing their reliability, energy efficiency, scalability, security, and latency.

For more information about innovative BLE applications visit *www.dewinelabs.com*.

Bluetooth

Goals and Tasks

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

- Evaluate the reliability, stability, and performance of BLE distance measurements and localization under realistic conditions, including harsh industrial-like environments and long-term deployments;
- Investigate and compare different antenna configurations (e.g., single antenna vs. array);
- Implement and evaluate different localization algorithms, focusing on their accuracy, precision, and robustness.

We offer the possibility to pay you for your work.

Target Group

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

Required Prior Knowledge

- Basic knowledge of Bluetooth Low Energy (BLE) and wireless communication;
- Experience with embedded system development in C (e.g., in Zephyr RTOS).

Contact Person

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