

## **INDOORS: Indoor Navigation with ambient Radio Signals**

The aim of the project is to explore indoor positioning based on ambient radio signals, such as FM and TV broadcasts, cellular network signals. While GPS has practically solved the problem of outdoor navigation, indoor localization remains an open challenge. Existing systems require dedicated localization infrastructure and work only within instrumented buildings. Broadcasted radio signals, in contrast, are tailored for indoor reception and are widely available even in less populated areas. Pioneering works have already demonstrated feasibility of indoor localization with FM, TV and GSM signals. However, they only proved the concept and more research is required to evaluate practical benefits and limitations of indoor localization based on ambient radio signals.

The following research questions will be addressed: 1) What is long-term localization performance of ambient radio based systems, in terms of accuracy, time stability and robustness to environment dynamics? 2) Which signals properties apart from signal strength can be used for localization? 3) What signal types/bands, signals features and localization methods, or their combinations, provide best performance, stability and robustness?

The project will focus on real-world experimental approach. Firstly, a multi-band radio signal acquisition and localization platform will be created, leveraging the flexibility of software-defined radio (SDR) approach. The SDR platform will be employed to systematically collect raw multi-band signal samples in multiple locations across several indoor testbeds, over the course of two years. In parallel with data collection, the project will develop relevant signal processing methods and localization algorithms; the latter will include both basic and advanced methods derived from state-of-the-art indoor localization systems. Analysis of the collected data with developed algorithms will provide insights to the research questions.

As a result, the project will provide understanding of practical bounds of ambient radio based indoor localization. Collected data will be released to scientific community, thus providing a common reference for evaluation of novel localization algorithms. All of the above will facilitate further research in this relatively young approach to indoor localization, possibly leading to cost-efficient widely available indoor localization, which will in turn boost the development of indoor location-based services.