Experimental Validation of the Ultra-wideband Technology-based Localization Platform

Piotr Karbownik, Grzegorz Krukar, Michal M. Pietrzyk, Norbert Franke, and Thomas von der Gruen

The ultra-wideband (UWB) technology offers promises for high accuracy (in the cm range) localization at distances of up to 10-20m in challenging indoor environments with multipath. However, there are just a few companies that offer UWB real time location solutions (Zebra, Time Domain, Ubisense etc.).

In this paper, we present our results of the experimental validation of the UWB localization platform with real-time signal processing. This platform is based on the time difference of arrival technique and the energy detection receiver with a sampling rate of 2 GS/s. The former removes the requirement for the ultra-precise (in the picosecond range) time synchronization between the tag and fixed nodes, and the latter allows for a feasible hardware implementation.

Compared to the work presented in our last paper from the 2011 edition of the IPIN conference where a 50cm x 50cm scenario was considered, this platform was deployed in a 10.45m x 4.85m measurement room. To compensate for the increased signal attenuation due to longer HF cables connecting the UWB antennas with the oscilloscope, additional hardware elements were necessary, i.e., low noise amplifiers and high pass filters. Moreover, a new key part of the localization system, i.e., a developed tag - a UWB pulse generator was subjected to a thorough experimental validation. As a reference system, a Nikon iGPS laser-based positioning and tracking system of a typical accuracy of 200 μm was used. Our results, accompanied with a dilution of precision analysis, show the 2D mean absolute error averaged over 24 measurement points to be lower than 10cm with the standard deviation of the absolute error lower than 4cm.