Localization and identification: System architectural components and core capability development for ultra-wideband (UWB) enabled sentient computing

Project Motivation/Objectives

A scalable (to thousands of nodes over area size of hundreds of meters) UWB location positioning prototype system capable of precise location positioning (centimeter level accuracy) of low power (<10mW) active tags, (<100 uW) passive tags and chipless tags

Applications

System may be used for pervasive healthcare, safety and disaster recovery, entertainment and gaming, smart space and collaborative workspace, education and training, logistics and environmental monitoring and protection.

Technical achievements

- A state of the art performance UWB low noise amplifier consuming only 12.9 mW of dc power with a power gain of 12.5 dB, 0.5 dB gain flatness, and 3.4-4.0 dB noise figure is developed
- A novel active matched filter for Gaussian derivative pulse in 3-5 GHz UWB-IR lower band is developed. The matched filter achieves a power gain of 9.8 dB and average SNR improvement of 4.6 dB. The matched filter when biased at 1.5V consumes 38mW of power
- Novel pulse generator circuits with greater than 10Vpp with state of the art ultra-low power consumption are developed
- A UWB backscattering RFID system with BPSK is studied. A dedicated roundtrip distance estimation algorithm able to mitigate clutter signal and system jittering is developed. Measured results show centimeter accuracy even in the presence of strong clutter and severe jittering
- Developed algorithms, components and system architecture for a scalable real time UWB localization system. The integrated system provide >10Hz real time UWB localization with centimeters level accuracy of active tags. The power consumption of active tag is <10mW. The tag power consumption can be <100uW for update rate of 0.1 Hz. The system is capable of ranging up to ~50 meters (LOS) for active tags.

Patents and papers

- 7 Renowned International Journal Publications
- 14 International Conference Publications

New projects

- Civil structure monitoring and debris breakout tracking – sponsored by DSTA
- Low power building blocks for scalable UWB-RFID real time precision localization system – submitted to NRF-POC

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