Ultrawideband Radar Using Communications Activity

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Introduction

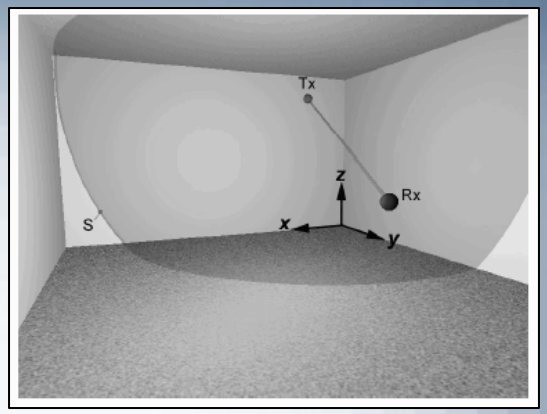
- Ultrawideband radar and communications use the same baseband processing and similar receiver design
- Reuse hardware and network activity
- Applications include: location-based services, indoor GPS, location-based security, augmented reality

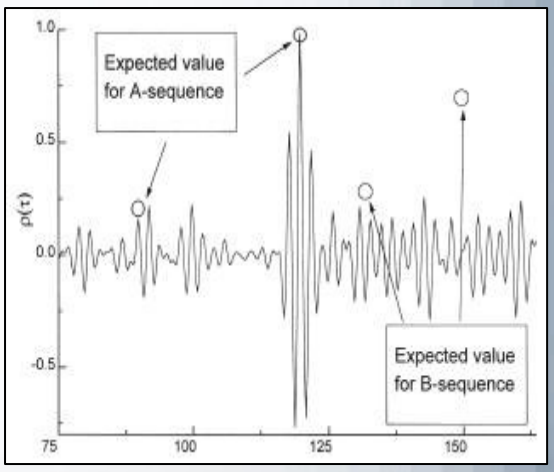
Background

- Existing RF triangulation based on received power
- IEEE 802.15 TG4a WPAN Task Group working on implementation
- Multi-user detection an optimal solution
- Successive interference cancellation one of few practical implementations
- Essentially distributed radar

Method 1: Signature-Based

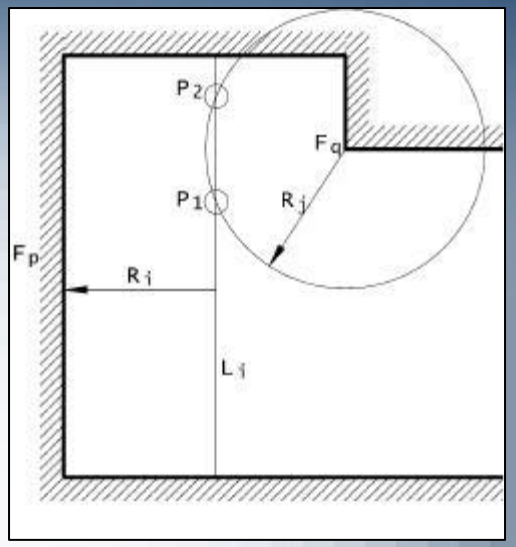
- Implements echolocation with ultrasound [Kazys, 2000]
- Based on early echolocation in bats and optimum correlation techniques [Altes, 1978]
- Once LOS distance is known, fit to best signature
- Suggests use of cyclic deconvolution with CDMA
- Extends perfectly to distributed radar

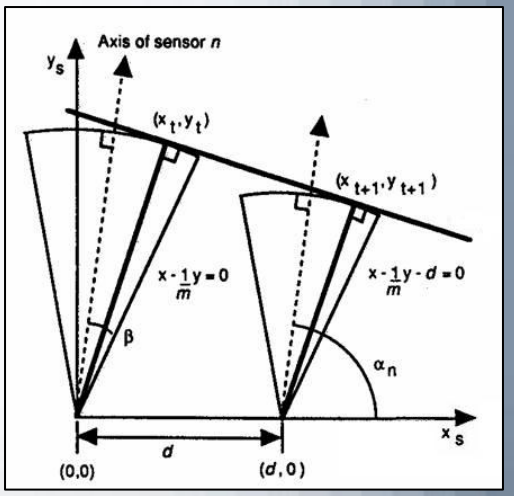




Method 2: Range-based

- Range data relocation [Jong & Leonard, 2000]
  - Specular propagation
  - Pair-wise interpretation-tree algorithm
  - MMSE all possible positions
  - occlusion test
- Feature map localization [Kuc & Seigel, 1987]
  - using regions of constant depth
  - multiple measurement
  - fit walls between corners
  - known shadow regions
- Translation and rotation [Santamaria, 1994]
- Extends to distributed environment using ellipses with time-of-flight info





Method 3: Source Localization

- Localization using vector sensor array in multipath environment [Rahamin, et al, 2004]
- Uses MUSIC, ESPRIT eigenstructure algorithms
- Polarization smoothing for correlated signals
- Extensions to wideband channel [Goncalves & Gounon, 1998]
- DOA information reduces complexity, good for multi-antenna communications