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Subject Area	Sensor, Actuator and Communication Systems

## Passive Covert Radio Detection and Ranging

A new digital signal processing approach

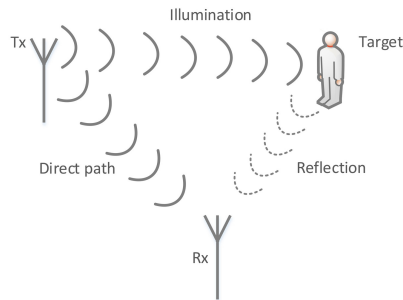


Figure 1: Measuring principle

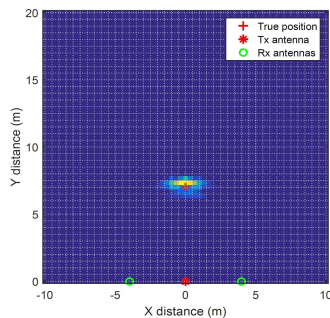


Figure 2: Static position solution.

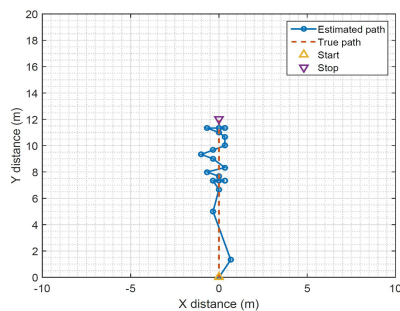


Figure 3: Tracking solution

**Introduction:** For many applications in buildings such as room management, security, people-tracking or people-counting, it is important to identify where a human stands as well as how and where he/she moves. One possible solution to track an individual human being is to make use of existing electromagnetic waves, which are available in almost all rooms (e.g. W-LAN, DVB-T, GSM and so forth). This approach is already in use in the field of airborne surveillance – known as passive RADAR. By developing a new signal processing method, this research is one of the first to use passive RADAR method for people tracking.

**Approach/Technologies:** Hence, the main objective of this thesis is to develop a new digital signal processing method for a passive RADAR system, to detect and track a human being. To reach this goal, latest research findings from digital signal processing and wireless communication, are considered, modified and applied. The developed measurement system detects and tracks a person in an area of 20m x 15m. The reflected electromagnetic waves are acquired using two high speed measurement platforms. To achieve precise results, the dilution of precision was determined and the best possible antenna positions are used. This new digital signal processing approach includes a so called «complex background subtraction», an algorithm to detect and optimize different reflections, a contour tracking algorithm allowing to recognize movement, as well as a Kalman filter with a linear motion model. The detected person is visualized on a 2D Cartesian coordinate system.

**Result:** Thus, the result of this research is a new digital signal processing method for the use in a passive RADAR system, which is able to detect and track a single person. This research may provide the grounds for interesting real world applications and be an impulse for future work in the field of people tracking with existing electromagnetic waves.