Karlsruhe Institute of Technology

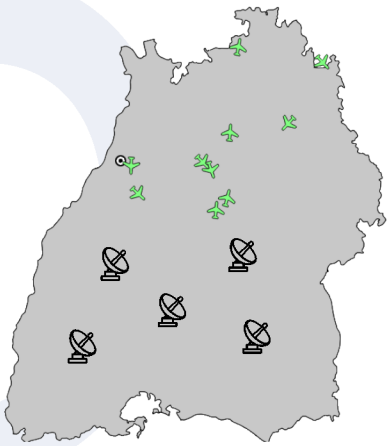
Department of Informatics
Institute for Anthropomatics und Robotics (IAR)
Chair for Intelligent Sensor-Actuator-Systems (ISAS)
Prof. Dr.-Ing. Uwe D. Hanebeck
https://isas.iar.kit.edu

Intelligent Sensor-Actuator-Systems

Bachelor/Master Thesis

Synchronization-Free Target Tracking with Software-Defined Radio

Civil air traffic surveillance is currently done with secondary surveillance radar. Hereby, a receiver network on the ground receives electromagnetic messages from the targets. Based on the detected times of arrival (TOA), multilateration methods can calculate target positions. To obtain accurate results, the receivers have to be time-synchronized to the order of 1ns, which is quite difficult for networks spanning hundreds of kilometers.



We are developing novel methods for target localization with unsynchronized receiver networks that are much easier to install, operate, and merge.

These synchronization-free methods need local differences of TOA of successive transmissions from a target. We plan to use software-defined radios (SDRs) to obtain such local time difference measurements. Ideal candidates are standard Mode A/C-transmissions from aircraft, but can potentially be extended to other types of targets and protocols.

Within the scope of this work, the following research questions can be addressed:

- Building an SDR receiver node to measure precise time differences
- Developing synchronization-free target localization and tracking methods
- Real data experiments with tracking of aircraft, drones, vehicles etc.

Requirements:
Students with a background in electrical engineering, computer science, physics, or mathematics. Pre-knowledge in communications engineering, software defined radio, and state estimation is welcome. Strong self-motivation, reliability, and critical mind are expected.

Emphasis:

Theoretical Study	
Software Implementation	
Hardware Implementation	

We offer:
- excellent support and advice
- highend infrastructure
- contact to industry and research partners

Contact:

Daniel Frisch
E-Mail: daniel.frisch@kit.edu