Autocalibration in Ubiquitous Tracking Environments

Thesis Proposal

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Motivation

• Calibration = Alignment of coordinate systems of different trackers
  – For autocalibration, a certain overlapping between the tracking areas is necessary.

• Why calibrate
  – Smooth transition between trackers
  – Sensor fusion: Eliminate systematic error

• Most AR setups do require a separate calibration step
  – Time consuming
  – System only calibrates itself when explicitly told to do so
Approach

- Calibrations are added as static measurements to the spatial relationship graph
- UbiTrack framework finds reference measurements when they are available
- Reference measurements are weighted by precision and averaged over time
- System calibrates during use
- Quality of calibration improves as further measurements are integrated
- Other sensor can be used as „ground truth“ or the overall system error can be minimized
Scenario
Scenario
Scenario
Challenges

• Dealing with uncertainty
  – Averaging over measurements with different precision
    • Simple least squares estimation is no option
  – Estimation of calibration quality
  – Where does the measurement precision covariance matrix come from?
    • Most sensors do not provide precision information
    • Manual measurement of each sensor
    • Can average sensor error be estimated in parallel to calibration?

• Estimation of other sensor parameters
  – Camera calibration
  – Drift in velocity or acceleration sensors
Next steps

- Improve my knowledge of statistics and state estimation
- Search literature for (auto-)calibration problems and solutions (especially robotics literature)
- Think about integration in UbiTrack and DWARF
- Later
  - Implementation
  - Testing
  - Evaluation
Questions?