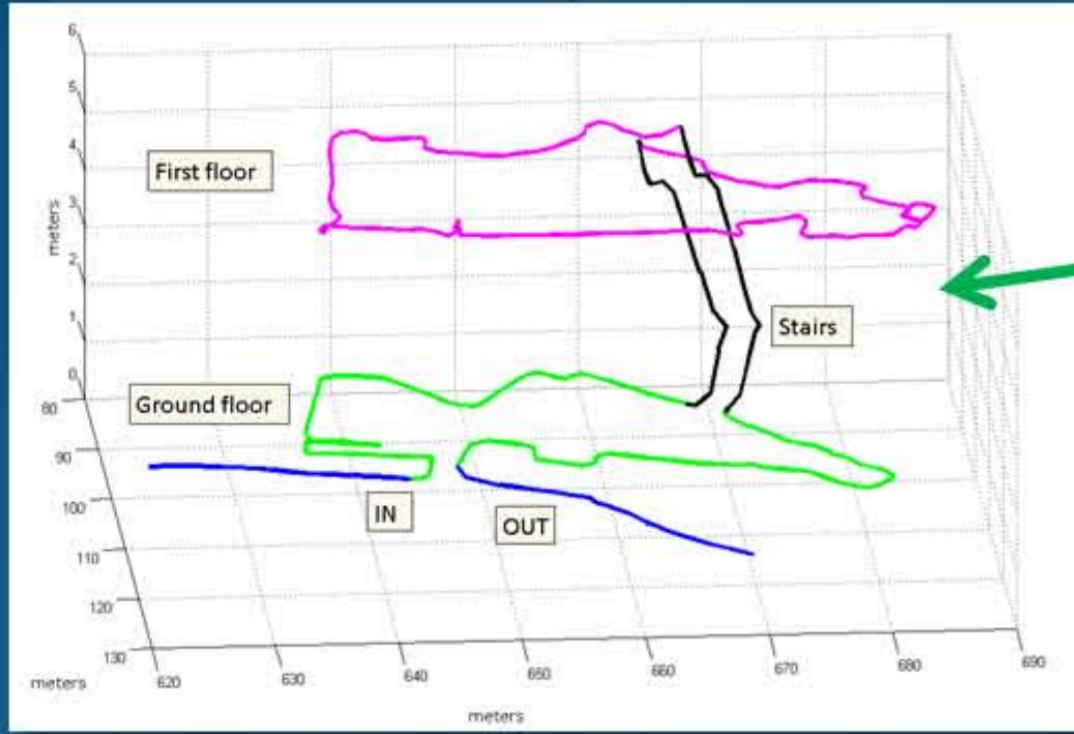


# ARIANNA: a Two-stage Autonomous Localisation and Tracking System

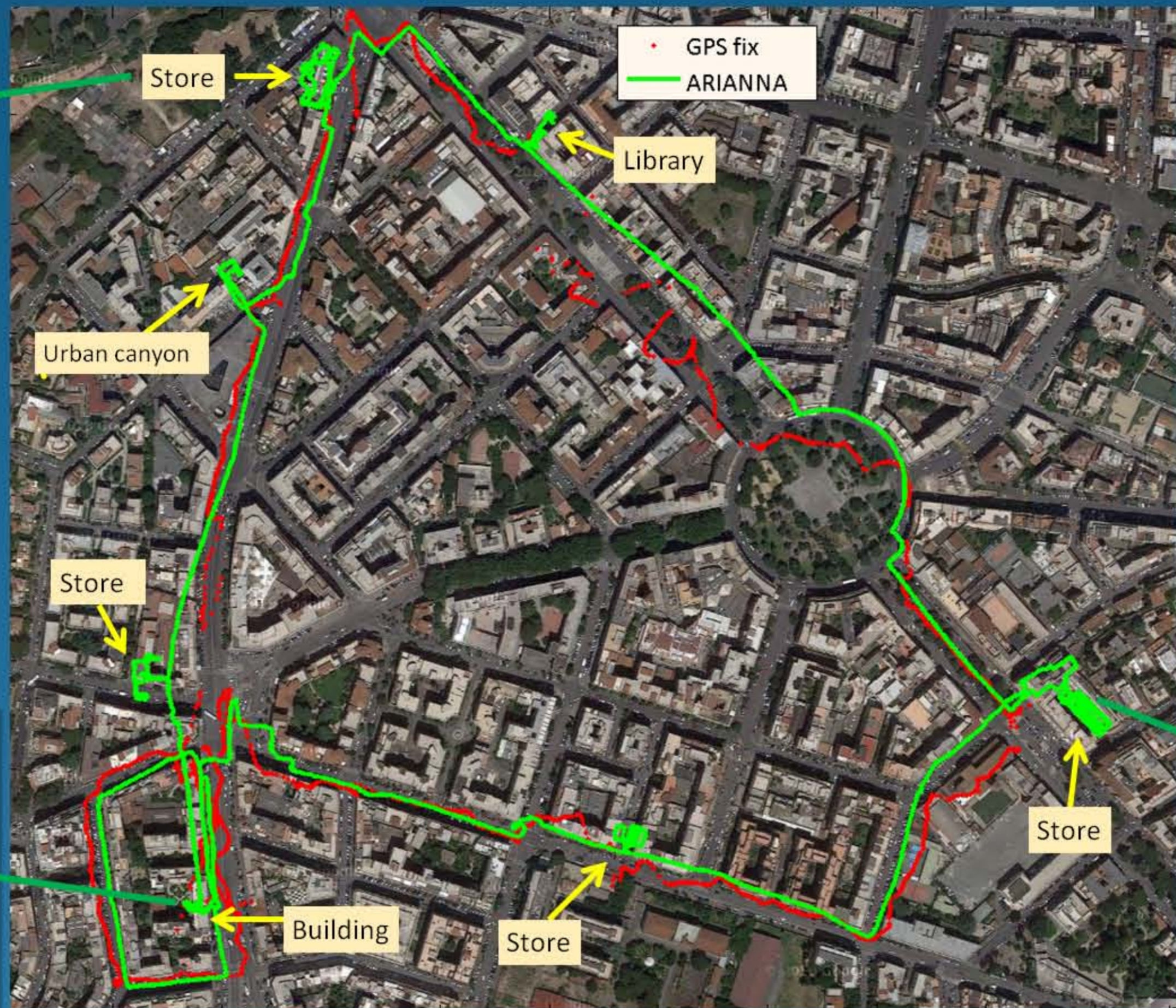


de Marinis E., Andreucci F., Gasparini O., Uliana M., Pucci F., Rosi G., Fogliuzzi F.

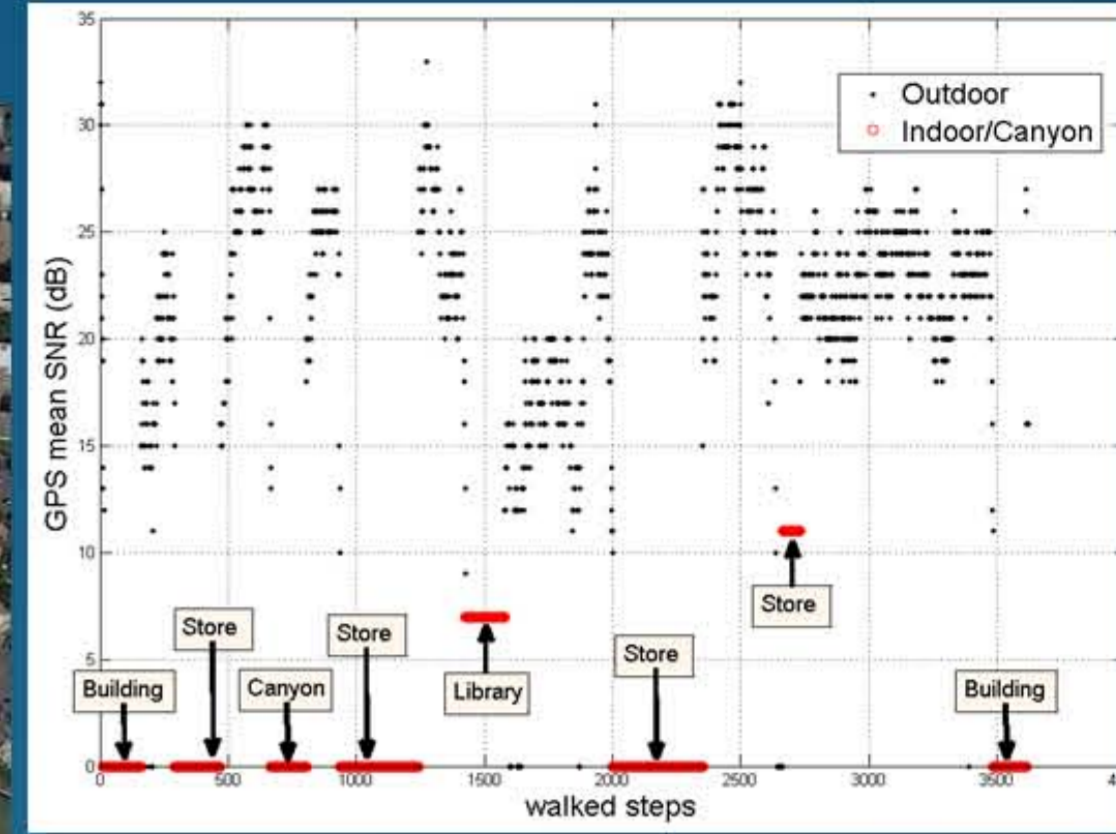
Indoor path: detail of a store



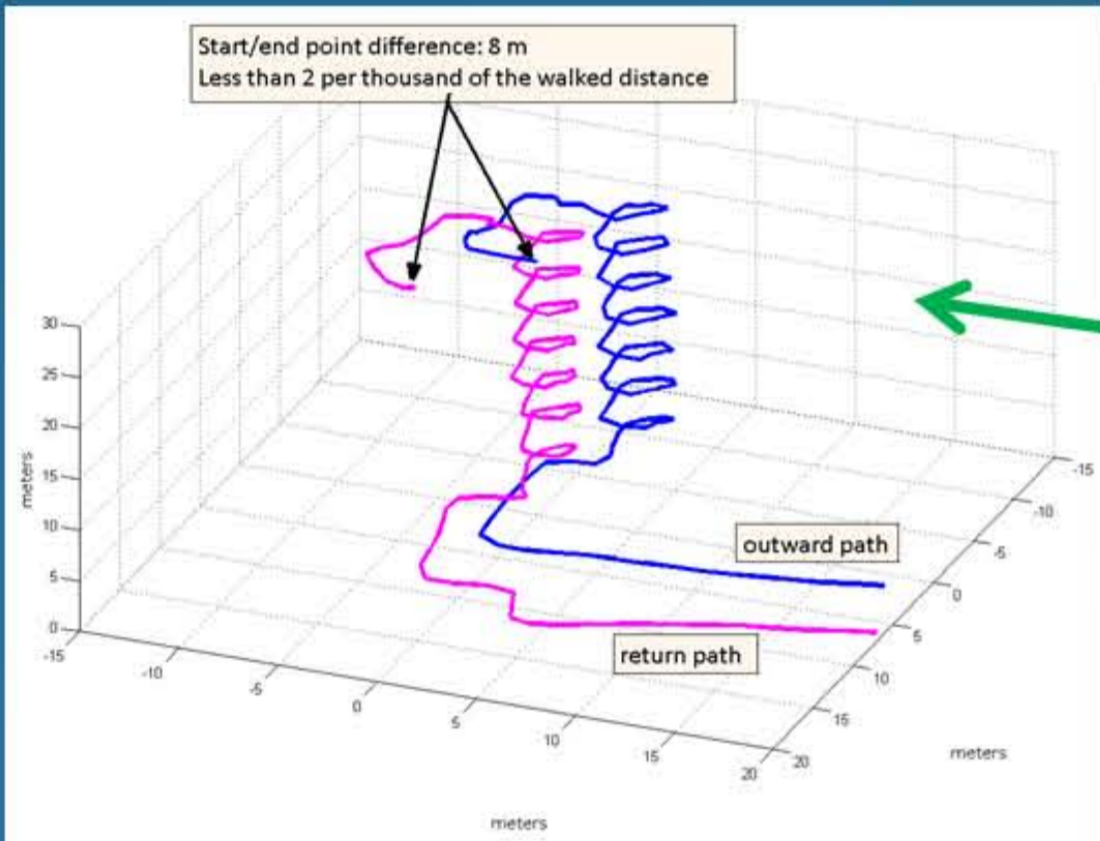
Round trip: walked path: 4.780 m



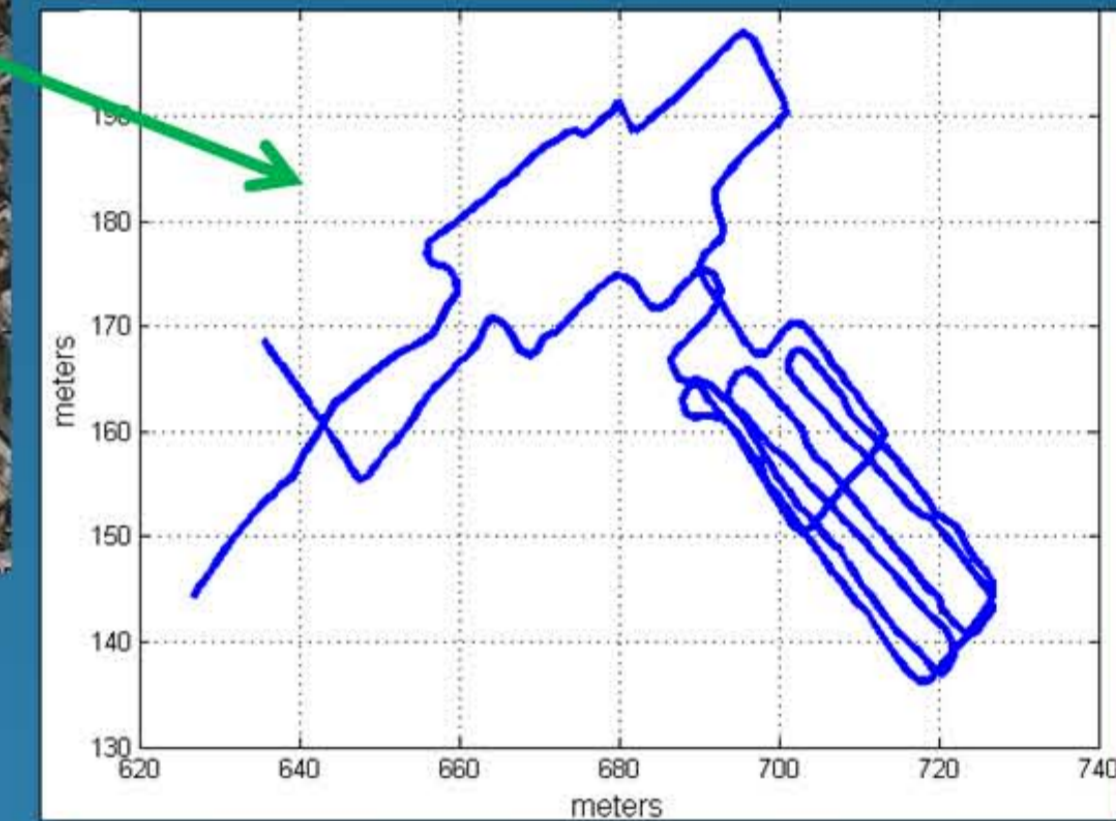
GPS: mean SNR during the whole experiment



Indoor path: start/end points (7th floor)



Indoor path: detail of a store



## Applications

Real-time localization and tracking of squads of operators (from a single operator to hundreds), seamlessly passing through mixed GPS-denied/available areas, in unknown environments.

Estimate the topographical depiction of buildings, hypogea and underground areas

## Requirements

- Low cost, low weight, highly customisable.
- Processing light enough to be hosted in a commercial smartphone.
- Zero-touch operation, wear-and-forget use.
- No need of any external infrastructure.
- No a priori knowledge of the environment.
- Seamless use of GPS information if and when reliable.
- No pre-operation setup or calibration.
- No operator-dependent training phases.

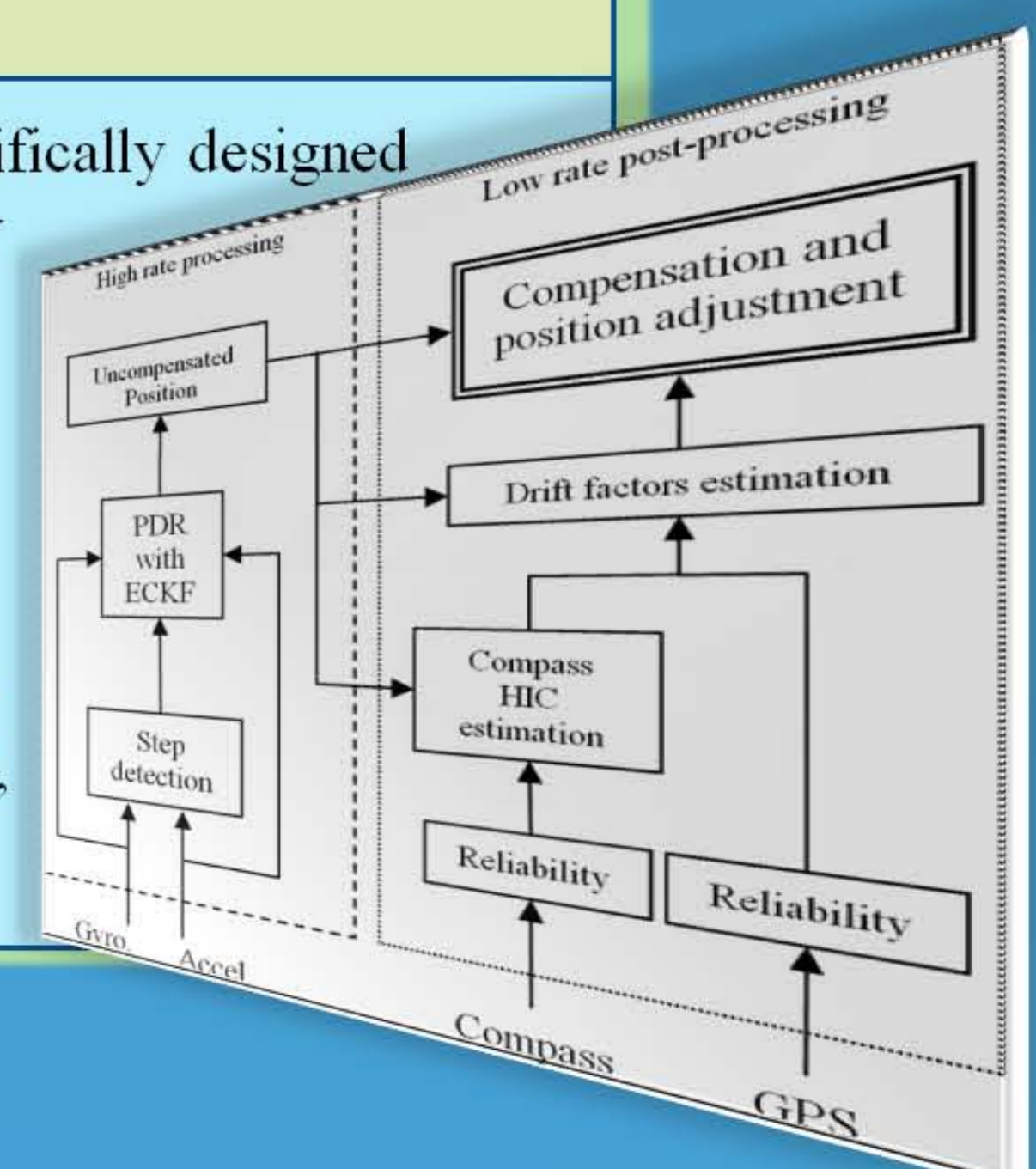
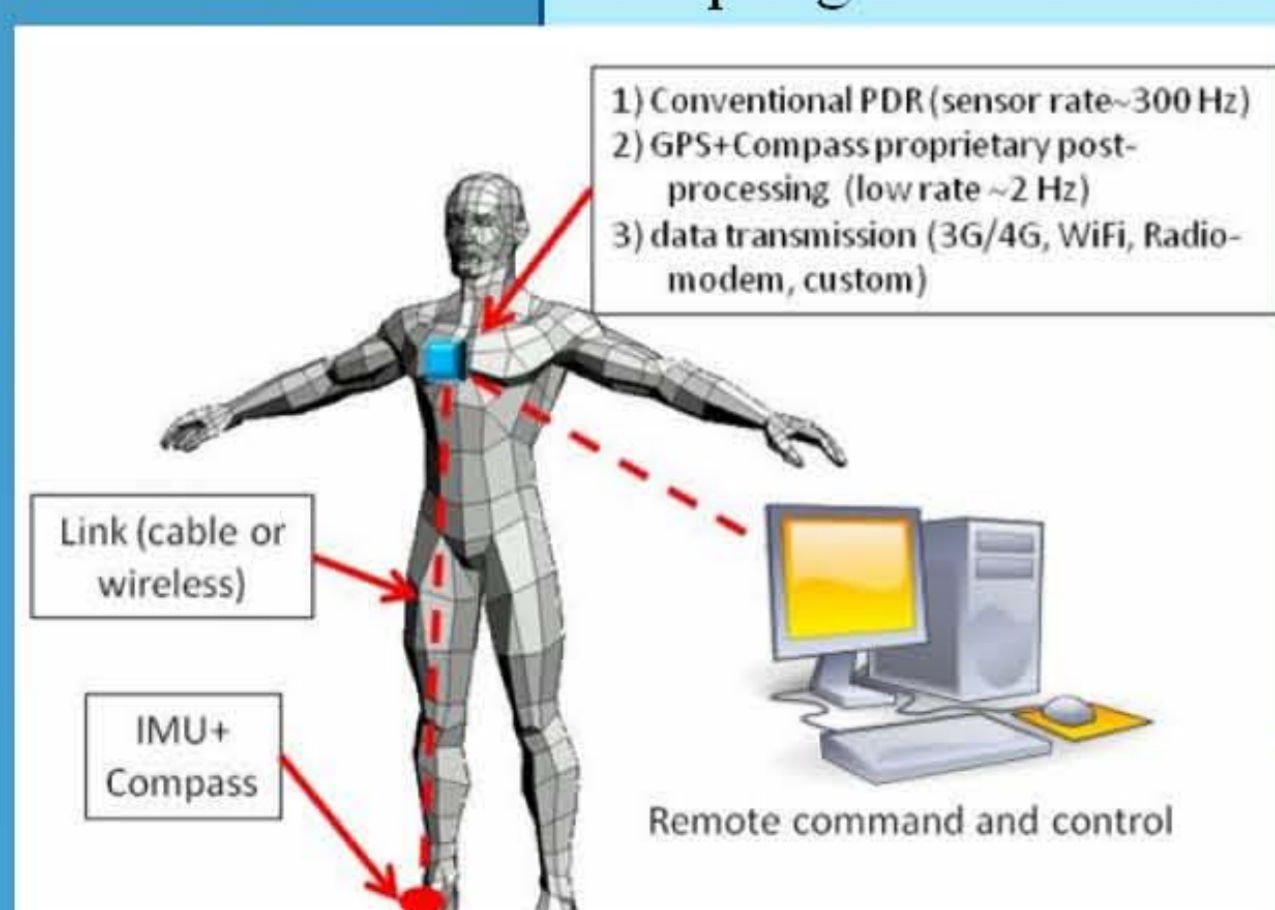
## Technology

- Shoe mounted, commercial-grade, low cost IMU and compass (uncalibrated).
- Wired or wireless link (BT) between the IMU and the Pocket-Size Processing Unit (PSPU).
- The PSPU is either a smartphone or a proprietary device; it hosts the GPS unit.
- The PSPU estimates the 3D position of the operator, which can be sent to the Control Center by customisable links (e.g. 3G/4G, TETRA, WiFi, ad-hoc Radio Modem).

## Methodology and results

ARIANNA is a customizable, novel pedestrian positioning and tracking system specifically designed for low-cost MEMS-based IMUs. The stringent requirements listed above are met by adopting a novel two-stage approach: the former is a conventional tracking process based on EKF and step detection; the latter is a low rate (e.g. 2 Hz) post-processing in which the sensor drifts are estimated and compensated.

An extensive validation campaign, performed with a wide range of experimental conditions, has systematically demonstrated a superior performance of ARIANNA w.r.t. PDR and, more important, the repeatability of its results.



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