

New positioning techniques

IAG's perspective

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Applications



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Outline

- IAG Commission 4 – Positioning and applications
- IAG Sub-commission 4.1 Multi-sensor systems
- IAG Working group 4.1.2 Indoor navigation systems
- Concluding remarks



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IAG Commission 4

Positioning and applications

- SC 4.1 Multi-Sensor Systems
- SC 4.2 Applications of Geodesy in Engineering
- SC 4.3 Remote Sensing and Modelling of the Atmosphere
- SC 4.4 Applications of Satellite and Airborne Imaging Systems
- SC 4.5 High-Precision GNSS
- SG 4.1 GNSS remote sensing and applications
- SG 4.2 IGS products for Network RTK and Atmosphere Monitoring



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SC 4.1 *Multi-sensor systems*

Chair: Dr. Dorota Brzezinska
Vice-chair: Dr. Naser El-Sheimy

Objectives:

- To follow the technical advances in navigation sensors and algorithms, including autonomous vehicle navigation, based on
 - positioning sensors and techniques such as GPS (and pseudolites), INS, wheel sensors, ultrasonic and magnetic sensors
 - positioning methods based on cellular networks and their hybrid with GPS



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SC 4.1 *Multi-sensor systems*

Objectives (cont'd):

- To follow the technical advances in mapping sensors (CCD cameras, laser range finders, laser scanners, radar devices)
- To standardize definitions and measurements of sensor related parameters
- To study and report on the performance of stand alone and integrated navigation systems
- To report on the development, possibilities and limitations of new multi-sensor system technologies.



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SC 4.1 *Multi-sensor systems*

Objectives (cont'd):

- To explore non-linear estimation and information fusion methods
- To facilitate extending the mobile mapping concept to environmental monitoring applications.
- To stimulate new ideas and innovation in:
 - navigation algorithms, sensor calibration, synchronization and inter-calibration
 - real-time processing and georeferencing
 - sensor and data fusion
 - automation techniques for information extraction



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SC 4.1 *Multi-sensor systems*

Objectives (cont'd):

- To study and monitor the progress in new applications of multi-sensor systems
 - transportation
 - engineering
 - car navigation
 - environmental monitoring
 - personal navigation
 - indoor navigation
 - etc.



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SC 4.1 *Multi-sensor systems*

Working groups:

- 4.1.1 Alternative integration algorithms
- 4.1.2 Indoor navigation systems
- 4.1.3 Multi-sensors systems for environmental monitoring applications



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WG 4.1.2 *Indoor navigation systems*

Chair: Dr. Guenther Retscher

Co-chair: Dr. Binghao Li

Terms of Reference:

to promote research and development in the area of indoor navigation

- WiFi, UWB and RFID
- ... in combination with DR sensors
- integration with GNSS
- optimal position estimation
- self calibration techniques for DR



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WG 4.1.2 *Indoor navigation systems*

Infrared, ultrasonic or radio signals

- Expensive installations
- Large number of receivers/transmitters

Systems:

- WiFi
- UWB
- RFID
- Combination with dead reckoning



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WG 4.1.2 *Indoor navigation systems*

WLAN / WiFi:

- 1 – 3 meter
- Existing infrastructure
- Fingerprinting
 - 3 – 5 access points
 - calibration time consuming and costly
- Trilateration: convert signal strength to distance (no calibration)



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WG 4.1.2 *Indoor navigation systems*

UWB:

- 0.2 - 2 meter
- ToA / TDoA
- no multipath fading



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WG 4.1.2 *Indoor navigation systems*

RFID

- 1 - 20 meter
- Cell-based positioning in range of active landmarks
- Trilateration: convert signal strength to distance
- Fingerprinting

WLAN with RFID: increased coverage area



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WG 4.1.2 *Indoor navigation systems*

Dead reckoning (DR) augmented with WLAN and RFID

- Relative position determination with RD
 - > no infrastructure
- Absolute position from WLAN and RFID
 - > correct drift rates



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Concluding remarks

- Public acceptance: not just accuracy, reliability of continuous position determination and integrity of systems
- Key words: integration, calibration, optimal position estimation
- Indoor: WLAN +/- UWB +/- RFID (+/- DR)



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