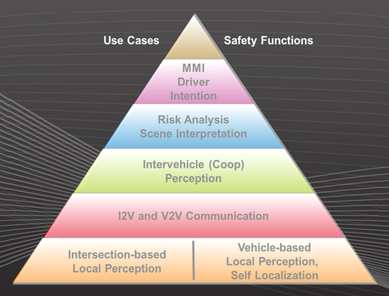

Vehicle Self-Localization
Tightly Coupled GNSS/INS

Project Ko-PER

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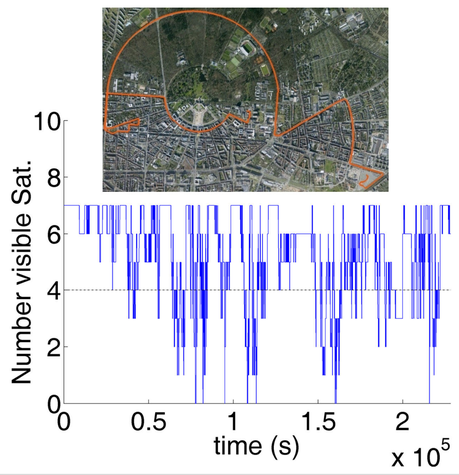
Enhancement of Satellite based Self-Localization

→ Increase of availability & robustness of satellite-supported (e.g. GPS) absolute positioning

- Low level data fusion of satellite raw-data of a Global Navigation Satellite System (GNSS) with an Inertial Navigation System (INS)
- Combination of complementary sensors (inertial and satellite)

→ Usage of satellite information in urban scenarios and alleys with reduced satellite visibility (less than 4 satellites) feasible

- Increase of GNSS availability by 16% (environment dependent)



Low Level Fusion of GNSS and INS Data

- Loosely Coupled System (LCS): Fusion of GNSS ego-position with INS
- Tightly Coupled System (TCS): Fusion of GNSS raw-data of each satellite with INS
- Usage of complementary benefits of INS & of GNSS → Error detection due to redundancy

Inertial Navigation (INS)

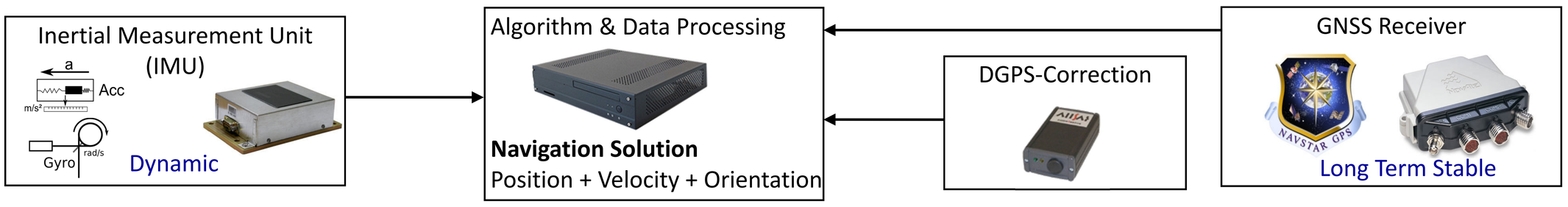
Sensors: Accelerometers & Gyroscopes

+ Accurate in dynamic scenarios
+ Always available and self-sufficient
- Short term stable → High drift errors in position & orientation due to bias

Satellite Navigation (GNSS)

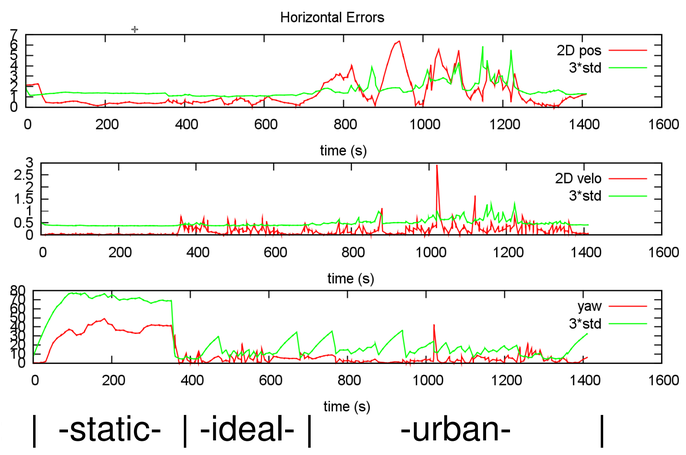
Sensors: GPS receiver & DGPS modem

+ Long term stable & absolute positioning
- Reduced availability (shadowing, > 4 sat.)
- Affected by multipath signal errors
+ Increase of precision by differential GPS

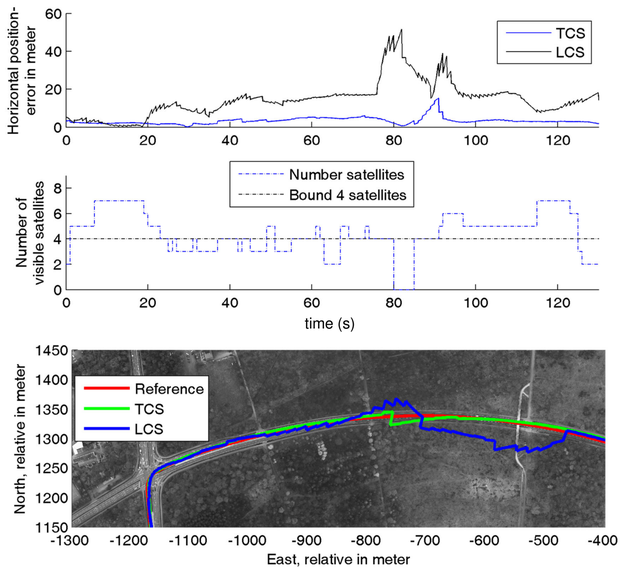


Results

- Reduction of position, velocity and orientation errors by TCS approach in urban scenarios
- Environment dependent increase of GNSS availability (16 %)



Drive-scenarios: | -static- | -ideal- | -urban- |



Perspective

- Additional fusion with vehicle onboard sensors (e.g. hodometry)
- Deep integration of GNSS signal processing → faster re-established GNSS availability (feedback to GNSS receiver, no complete loss of satellite tracking in tunnels)

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