GLOBAL NAVIGATION SATELLITE SYSTEM

Global Navigation Satellite System (GNSS) is a radio-navigation technology that provides Position, Velocity, and Time (PVT) for enabled receivers. It leverages the reception of synchronous ranging signals transmitted by satellites like the Global Positioning System (GPS), Galileo, Beidou, and GLONASS. Modern GNSS receivers rely on accurate phase measurements from multi-constellation (MC), multi-frequency (MF) signals for meter-level accuracy.

Advanced augmentation paradigms such as Real-Time Kinematic (RTK) lead to decimeter-level accuracy, thus constituting an empowering technology for service robotics applications.

GNSS can be complemented by auxiliary proprioceptive sensors and network-based cooperative data to cope with challenging conditions in a harsh environment.

ULTRA WIDEBAND REAL-TIME LOCALIZATION SYSTEM

Ultra wideband is a radio technology that can use a very low energy level for short-range, high-bandwidth communications. As opposed to Narrowband and Spread-spectrum technologies that make use of continuous signals, an UWB signal is composed of a series of pulses. The consequence is a high temporal resolution and an extremely wide instantaneous bandwidth.

These characteristics make UWB technology particularly suitable for distance measurements, and thus localization. Typically, UWB RTLS can reach a 3D accuracy of 30 cm with high multipath resolution, high penetration capabilities, and low interference with existing signals.

ONGOING ACTIVITIES

- **PATHfinder**
  GNSS and UWB can be cooperatively combined to achieve indoor-outdoor seamless localization capabilities and high reliable and accurate outdoor positioning information.
  PATHfinder project designs and implements a cooperative system for emergency management in challenging scenarios.

- **PRIN Next Generation - Ultra WideBand**
  We are designing a mobile localization infrastructure to improve localization in partially GPS-denied environments. Our idea is to use a swarm of 4 drones equipped with UWB devices as a “local GNSS-like constellation” that allow high precision localization in harsh environments.

- **ESA-ESRIC Space Resources Challenge**
  Design and implementation of an integrated system composed of a rover combined with an autonomous flying drone for Moon prospecting. To enable a high level of autonomy of the robotics system, the architecture does include an innovative localization method based on UWB anchors.

- **Jamming, Spoofing and Cyberattacks Countemeasures**
  Intentional radiofrequency interferences can disrupt GNSS operations. Interference mitigation techniques can ensure an improved resilience to the navigation systems.

RELEVANT APPLICATION FIELDS

- Precision agriculture
- Asset tracking
- Location-based services
- Autonomous driving
- Planetary exploration
- Delivery drones and robots