



# Profound-UDR

## No Speed, No Problem, PPI can still navigate you anywhere

Continuous, Accurate and Reliable Navigation with Dollar-Level Sensors

*PPI's Profound-UDR is a cutting-edge sensor fusion navigation firmware for vehicular IoT and asset tracking applications in challenging GNSS environments such as tunnels, indoor parking, urban centers, and multilevel highway junctions relying only on consumer grade inertial sensors with no speed update from the moving vehicle.*

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### Sustained Robustness wherever you drive

Profound-UDR navigation library is able to keep high positioning accuracy with errors **less than 2% of the travelled distance for several minutes of GNSS signal loss** with only dollar-level inertial sensor measurements. **No speed update, no problem, Profound-UDR can still navigate you.**



### Initialize and Start from Anywhere

The Profound-UDR navigation library initializes automatically within few minutes in open sky with no need to specific vehicle dynamics. After initialization, **the library can start from covered or underground parking.**



### Unique Navigation Algorithm

The Profound-UDR navigation library feature a special inertial sensor mechanization, and advanced dynamic error models that minimize sensor errors and prevent them to propagate through the navigation algorithm, resulting in a more reliable 3D navigation performance.



### Smartly Fuse GNSS and Inertial sensor Measurements

The Profound-UDR navigation library recognizes the GNSS environment and automatically weights the GNSS updates accordingly. The smart combination of GNSS updates and inertial sensor measurements result in continuous, accurate and reliable positioning in all environment even in the absence of vehicle's speed update.



### Unique Integration Filter Extending Standalone Operation

The Profound-UDR navigation library utilizes unique multi-sensor fusion filter with online sensor error calibration to extend the operation of the system where many of the standard filters will fail.

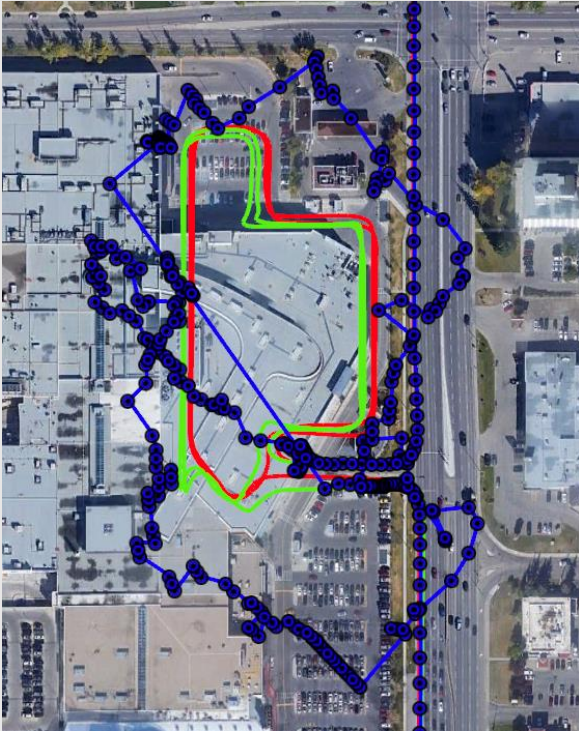


### Customization

Profound-UDR library can be customized to target any grade of IMU and GNSS receivers. Profound-UDR has been optimized to run in real-time for a variety of mainstream processors including ARM Cortex-M4F based processors to provide the most accurate and reliable 3D navigation at a low-cost



## Underground Parking



## Multipath – Downtown



Blue – GNSS, Red: Reference Solution using High End INS/GNSS System (cost > \$50,000), Green: Profound-DR 3D Navigation Solution

## Key Advantages

- Integrated GNSS with either 6 DoF or 10 DoF sensors.
- Plug-and-play capability with no need to any special vehicle dynamics during system initialization.
- Continuous and robust 3D navigation in urban and denied GNSS areas.
- Robust performance using dollar-level consumer grade MEMS inertial sensors with errors less than 2% of the distance travelled even during long GNSS signal outages of several minutes.
- Real-time sustained performance for up to 10 Hz.
- Ability to start in denied GNSS environment such as underground parking where no GNSS updates are available.
- Open to work with GPS, GLONASS, BeiDou, and Galileo.
- Can integrate with other sources of update such as HD maps, vision, LiDAR, and radar.
- Fast acquisition of GNSS satellite signals at the end of long GNSS outages.

## Targeted Applications

Profound-UDR provide continuous and accurate 3D navigation for:

- Asset Tracking
- Integrated positioning and navigation for moving platforms (indoors and outdoors)
- Internet of things (IOT)

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