Precise Indoor Location

A Motion Tracking Solution for Indoor Location Using Smartphones

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OVERVIEW

Precise Indoor Location (PIL) enables a smartphone to locate people indoors, in real-time and without requiring any dedicated infrastructure, by exploiting the multitude of sensor data sources found on common smartphones. Designed in a modular and self-evaluating fashion, this system can run on a vast range of devices, adapting to the available resources, while keeping the implementation costs at a very low mark.

Calculated positions are displayed on an Android application, either within a blank canvas, a custom map or a Google Maps widget (Figure 1).

Ultimately, this technology aims to provide an indoor positioning backbone to be used by everyone, everywhere.

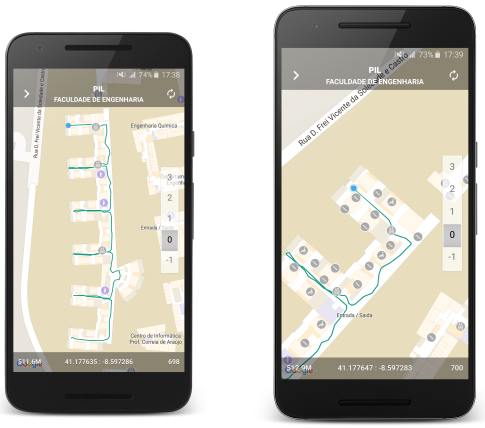

Figure 1: Screenshots of a route traced with PIL's algorithms inside a building available on Google Maps.

TECHNOLOGY

Starting from a proprietary sensor fusion algorithm, this system precisely calculates movement and orientation variations in real-time, performed with an innovative dead reckoning approach based on cyclic human walking patterns. Simultaneously, magnetic field data and Wi-Fi signals are processed, to be matched against a multi-dimensional feature spot map, allowing for positioning adjustments and self-evaluation of the system's performance.

All this information is merged inside a particle filter, which dynamically assigns weights to each source based on their behavior and outcome, prioritizing the most relevant contribution at any given time. The result is then incrementally fitted inside the current building's floorplan, leading to an improved localization accuracy.

After each particle filter iteration, a position is determined and translated either to custom map coordinates or a latitude and longitude pair.

REQUIREMENTS

PIL was designed to run on an Android smartphone equipped with an inertial measurement unit (with an accelerometer, a gyroscope and a magnetometer) and a Wi-Fi radio. Scanning the region of interest in advance is required to generate the appropriate feature spot maps, while access to floor plan data is needed to improve algorithms performance and to display the positioning outcome.