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Versatile Geo-referenced Maps for Indoor Navigation of Pedestrians

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ABSTRACT

We propose a system enabling users to capture the data needed to construct maps of building interiors, complemented by a smartphone-based pedestrian navigation application utilizing these maps.
For this purpose, the data collector captures photographs of evacuation plans which are processed by the system using a suitable image processing pipeline. As a result, a coarse floor map is available, consisting of polygonal room outlines and identified staircases, where possible. Furthermore, the system derives the data collector's initial position (which is marked in the plan) and orientation from the photographed plan.
The coarse model is further refined by geometric or semantic data geo-referenced by a pedestrian positioning solution. In a prototype configuration, two foot-mounted IMUs are used to process position and orientation with an extended Kalman Filter. Using the such derived position, an automatic derivation of door openings as wall impacts in angles around 90 degrees as well as manually entered room numbers is possible.
We make the final floor map available via OpenStreetMap. This transformation translates the coarse area-based ground truth into walkable paths annotated with additional semantic annotations for room numbers and associated office occupants.
Following this, a wide user community can use these maps for indoor navigation using only the sensors incorporated in typical smartphones.
Our proposed system therefore allows the easy creation and refinement of indoor maps directly applicable for navigation.

KEYWORDS: foot-mounted IMU, indoor navigation, floor maps, map refinement