

When Accuracy Meets Reality: Rethinking Localization for Guiding Vulnerable Users

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Abstract

The ongoing pursuit of enhanced localization accuracy and expanded coverage is driving significant progress in wireless positioning technologies. However, research in the field of pedestrian navigation, particularly about vulnerable users, has demonstrated that accuracy alone is insufficient to ensure the reliability, usability and trustworthiness of navigation guidance in real-world conditions.

In this keynote, I will present a navigation-centred perspective grounded in several years of research on smartphone-based pedestrian localization, inertial sensing, map information and AI-driven personalization. Drawing upon a comprehensive set of long-term real-life experiments involving visually impaired and sighted pedestrians, we will demonstrate how user diversity, sensor placement and environmental variability fundamentally impact navigation performance.

By means of a selection of illustrative examples drawn from field deployments, encompassing 350 km of walking data, we will show how personalised gait modelling can significantly reduce variability in inertial navigation, achieving consistent errors of 5–9 cm per stride across users and device placements. At the system level, the integration of inertial sensing with map constraints and contextual cues enables meter-level positioning accuracy with low-cost sensors, which has proven sufficient for safe and reliable pedestrian guidance.

Moving beyond performance metrics alone, the talk outlines emerging directions for navigation systems, including smarter map representations, recalibration through everyday user/environment interactions and more symbiotic human/device partnerships. These perspectives indicate the potential for navigation solutions that can adapt to individual mobility behaviours and changing contexts.

In this perspective, future localization technologies will reach their full impact only when precision becomes a means rather than an objective, embedded within navigation systems that learn, adapt and co-evolve with their users.

Biography

VALÉRIE RENAUDIN is a Professor at Gustave Eiffel University, France. She obtained an MSc degree in Geomatics Eng. in 1999, and a PhD in Computer, Communication, and Information Sciences at l'Ecole Polytechnique Fédérale de Lausanne (EPFL) in

2009. Her international career includes positions such as the Technical Director of Swissat in Switzerland, where she pioneered real-time network based GNSS positioning solutions and a Senior Research Associate at the University of Calgary in Canada. As the Geopositioning Laboratory (GEOLOC) leader at Gustave Eiffel University, Valérie has cultivated a team of experts specializing in positioning and navigation for soft mobility modes for travelers and vulnerable users. Her research centers on seamless indoor outdoor navigation methods, integrating GNSS, inertial and magnetic data to enhance sustainable personal mobility, particularly for pedestrians. In 2021, she founded nav4you, a company dedicated to developing location-based services for the safety of firefighters. Valérie is also the founding Editor-in-Chief of the IEEE Journal of Indoor and Seamless Positioning and Navigation (J-ISPIN) and a steering committee member of the Indoor Positioning Indoor Navigation (IPIN) international conference, underscoring her commitment to shaping the future of geomatics and navigation on a global scale.