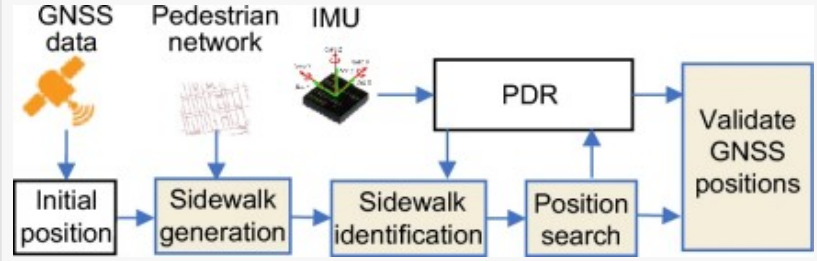
New GNSS technique helps pedestrians navigate skyscraper shadows

GA, UNITED STATES, March 7, 2025 /EINPresswire.com/ -- A new smartphone-based Global Navigation Satellite Systems (GNSS) positioning technique, aimed at overcoming the challenges of urban canyons, has been developed. In these dense environments, tall buildings often block or reflect satellite signals, leading to inaccuracies in pedestrian navigation. The new method, known as “sidewalk matching,” uses smartphone sensors and a simple pedestrian map to improve positioning accuracy to within 5 meters. This innovative approach is a game-changer for applications that require precise identification of street sides, such as pedestrian collision avoidance, ride-hailing services, and jaywalking monitoring. By enhancing measurement redundancy, this technique addresses the shortcomings of traditional GNSS systems in complex urban landscapes.



Flowchart of sidewalk matching.

Global Navigation Satellite Systems (GNSS) are essential for many location-based services, but their effectiveness is severely compromised in urban canyons. The dense clusters of tall buildings cause multipath and Non-Line-Of-Sight (NLOS) errors, leading to significant positioning inaccuracies, particularly in the cross-street direction. This makes it challenging for pedestrians to determine which side of the street they are on, a critical element for accurate navigation and safety. Existing solutions, such as 3D building models or deep learning-based signal classification, either require impractical resources or extensive training data. There is a clear demand for a more accessible, reliable approach to enhance pedestrian navigation in such environments.

A team of researchers from Shenzhen University, The Hong Kong Polytechnic University, and Wuhan University have developed a new GNSS positioning technique, detailed in their study (DOI: 10.1186/s43020-025-00159-8) published on February 24, 2025, in Satellite Navigation. The new method, "sidewalk matching," uses smartphone sensors combined with pedestrian maps to provide accurate positioning in challenging urban canyons. By dynamically identifying the side of the street and filtering out NLOS signals, this technique significantly improves GNSS accuracy, making it ideal for real-time pedestrian applications.

The sidewalk matching technique relies on smartphone sensors and pedestrian network data to enhance GNSS accuracy. The algorithm works by identifying which half of the sky has more Line-of-Sight (LOS) signals, enabling it to determine the correct side of the street. By analyzing the Carrier-to-Noise Ratio (C/N0) and satellite azimuth angles, the system can filter out faulty measurements using a sliding window method, ensuring that only reliable data is used. A key feature is the incorporation of Pedestrian Dead Reckoning (PDR), which uses smartphone accelerometers and gyroscopes to validate GNSS positions, especially at intersections where traditional methods may struggle. Extensive tests conducted in Hong Kong demonstrated that the technique provides positioning accuracy of less than 5 meters—far superior to traditional GNSS systems, which can have errors exceeding 18 meters in urban canyons.

“This sidewalk matching technique represents a significant leap forward in urban pedestrian navigation,” said Dr. Duojie Weng, the lead researcher. “By combining smartphone sensors with pedestrian network data, we’ve created a practical solution that doesn’t require costly 3D models or large training datasets. This makes it an accessible, cost-effective solution for a wide range of real-world applications, from pedestrian safety to ride-hailing services.”

The sidewalk matching technique has far-reaching implications for various pedestrian-centric applications. It promises to significantly improve pedestrian collision avoidance systems by providing real-time, precise positioning even in densely built urban areas. Ride-hailing services can leverage this technology to enhance pick-up and drop-off accuracy, while jaywalking monitoring systems can more reliably determine which side of the street a pedestrian is on. Additionally, the method could be a game-changer for visually impaired individuals, providing greater independence and safety in urban environments. Thanks to its reliance on widely available smartphone technology, this innovation has the potential to become a standard feature in future navigation systems, revolutionizing how pedestrians navigate cities.

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