

Research on Indoor Positioning Technology Based on Smartphones

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Abstract: This study investigates the development of an indoor positioning system leveraging the ubiquitous capabilities of smartphones. While Global Navigation Satellite Systems (GNSS) are effective outdoors, their signals are unreliable within enclosed structures, creating a critical gap for location-based services in environments such as shopping malls, hospitals, and airports. This research addresses this challenge by designing and evaluating a hybrid positioning algorithm that fuses data from multiple onboard smartphone sensors, including Wi-Fi fingerprinting, Bluetooth Low Energy (BLE) beacons, and inertial measurement units (IMUs). A key focus is on mitigating the cumulative errors inherent in dead reckoning through sensor fusion and machine learning techniques. Experimental results demonstrate that the proposed system achieves a mean positioning accuracy of under two meters in complex indoor settings, significantly outperforming single-sensor approaches. The findings underscore the feasibility of a cost-effective, infrastructure-lean solution that operates on existing consumer hardware, offering substantial potential for navigation, asset tracking, and context-aware applications without requiring specialized equipment.

Keywords: Indoor positioning, Smartphone, Localization technology, Indoor navigation