An improved hybrid indoor positioning system based on surface tessellation artificial neural network

ABSTRACT

In indoor environments, accurate location or positioning becomes an essential requirement, driven by the need for autonomous moving devices, or to identify the position of people in large spaces. Single technology schemes which use WiFi and Bluetooth are affected by fading effects as well as by signal noise, providing inaccuracies in location estimation. Hybrid locating or positioning schemes have been used in indoor situations and scenarios in order to improve the location accuracy. Hence, this paper proposes a hybrid scheme (technique) to implement fingerprint-based indoor positioning or localization, which uses the Received Signal Strength (RSS) information from available Wireless Local Area Network (WLAN) access points as well as Wireless Sensor Networks (WSNs) technologies. Our approach consists of performing a virtual tessellation of the indoor surface, with a set of square tiles encompassing the whole area. The model uses an Artificial Neural Network (ANN) approach for position estimate, in which related RSS is associated to a 1 m × 1 m tile. The ANN was trained to match the RSS signal strength to the corresponding tile. Experimental results indicate that the average distance error, based on tile identification accuracy, is 0.625 m from tile-to-tile, showing a remarkable improvement compared to previous approaches.

Keyword: Artificial neural network; Fingerprinting; Hybrid; Indoor localization; WiFi; WSN