Abstract

With the growing need of mobility, efficient indoor navigation system are gaining more and more importance. Positioning systems are becoming increasingly vital to today's pervasive wireless technology. Even though Global Positioning System (GPS) based localization is dominant in outdoor navigation, its signal structure and signal levels are barely sufficient in indoor environment. Present day indoor navigation systems sometimes relay on high sensitivity (HS) GPS receivers augmented with dead reckoning (DR) sensors or mostly on wireless technologies, such as Wireless LAN (WLAN), Infra Red (IR), or Bluetooth, that are existing as part of the communication infrastructure. The resulting cost advantage compared to pure localization systems has drawn much attention to them. However, the accuracy and reliability in position estimates obtained using such systems is largely erroneous for indoor navigation.

Even though Inertial Measurement Units (IMU) and WLAN infrastructure are separately used for indoor positioning, not much work is done in integrating both. The object of this paper is to integrate MEMS IMU measurements with a WLAN received signal strength (RSS) based positioning platform to obtain reliable position estimates, combining short-term accuracy of inertial sensors with long -term stability of absolute WLAN positioning. Here, HSGPS is replaced by the WLAN positioning platform to update the position estimates provided by IMU.

In this paper we propose an architecture and localization algorithms to fuse the WLAN position estimates with the IMU raw data using a simple two-step procedure and a more sophisticated one using Kalman filters. The WLAN position estimates are periodically obtained by location fingerprinting using neural networks, and used to update the dead reckoning navigation of the IMU. Real-world test results conducted in an office environment compare RSS-based, DR-based and the new, hybrid WLAN/IMU positioning, and show the reduction of position error of the hybrid system in addition to increased reliability.