RFID Indoor Tracking based on Inter-tags Distance Measurement

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Abstract

Indoor tracking and localization is a crucial ingredient in many ubiquitous computing applications and robotics. In many applications there is the need to know the location of the objects. While in the near future everything will be tagged with Radio Frequency Identification (RFID) tags, the localization of these tags in their environment is becoming an important feature for the RFID based ubiquitous computing applications. Due to its lower cost and its technical capabilities, RFID Tagged object tracking can have a wide diverse variety of applications including scientific, military, and public safety. In this paper we propose a tracking algorithm for objects attached by UHF RFID tags by means of two RFID antennas and landmarks to reduce the localization cost and environment complexity. This algorithm uses RFID map made from passive or active references tags with known location (landmarks) to locate any unknown tag detected by the RFID Reader antennas. It measures the distances between the readers and the common detected tags using the large scale path loss propagation model, and calculates the distance between the unknown tag and all the detected landmarks (Inter-tags distance). With the multilateration technique the system is able to estimate the position of the unknown tag. The location estimation of the target will be independent to the reader’s position. The research challenge corresponds to achieve an accurate indoor tracking system using two mobile RFID Readers taking in consideration the limitation of RFID technology. This tracking algorithm is based on Received Signal Strength (RSS) measurement to measure the reader-tags distance and target-landmarks distance to estimate the target location. To minimize the effect of the RSS and the process measurement noises on the position estimation, Maximum Likelihood Estimator (MLE), Map Matching and Kalman filter are applied. Here, we investigate the use of Kalman filter to improve the precision and RFID map matching to improve the accuracy. Results obtained after simulations demonstrate the validity and suitability of the proposed algorithm to provide high performance level in terms of accuracy and scalability.