

Title: Indoor Spatial Query Evaluation with Bayesian Filtering Techniques

Abstract: People spend a significant amount of time in indoor spaces (e.g., office buildings, subway systems, etc.) in their daily lives. Therefore, it is important to develop efficient indoor spatial query algorithms for supporting various location-based applications. However, indoor spaces differ from outdoor spaces because users have to follow the indoor floor plan for their movements. In addition, positioning in indoor environments is mainly based on sensing devices (e.g., RFID readers) rather than GPS devices. Consequently, we cannot apply existing spatial query evaluation techniques devised for outdoor environments for this new challenge. Because Bayesian filtering techniques can be employed to estimate the state of a system that changes over time using a sequence of noisy measurements made on the system, in this research, we propose the Bayesian filtering-based location inference methods as the basis for evaluating indoor spatial queries with noisy RFID raw data. Furthermore, two novel models, indoor walking graph model and anchor point indexing model, are created for tracking object locations in indoor environments. Based on the inference method and tracking models, we develop innovative indoor range and k nearest neighbor (k NN) query algorithms. We validate our solution through extensive simulations. Our experimental results show that the proposed algorithms can evaluate indoor spatial queries effectively and efficiently.

Bio: Wei-Shinn Ku received his Ph.D. degree in computer science from the University of Southern California (USC) in 2007. He also obtained both the M.S. degree in computer science and the M.S. degree in electrical engineering from USC in 2003 and 2006, respectively. He is a professor with the Department of Computer Science and Software Engineering at Auburn University. His research interests include databases, data science, mobile computing, and cybersecurity. He has published more than 100 research papers in refereed international journals and conference proceedings. He is a senior member of the IEEE and a member of the ACM SIGSPATIAL.