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Received Signal Strength Based Target Localization and Tracking Using Wireless Sensor Networks



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Preface

Location awareness is a key component in many industrial, scientific, and military indoor and outdoor applications as well as a wide variety of present location-based services (LBS). Although GPS is a more popular technique to get location updates very easily, limited accessibility GPS signals in most of the indoor as well as outdoor environmental setup motivate researchers to design GPS-less localization system. Being one of the key technologies of twenty-first century, the low powered and low cost wireless sensor network (WSN) paved the way for the design and development of GPS-less system for indoor as well as outdoor localization and tracking (L&T) applications. The merits of the WSN technology over the rest of the other technological alternatives are: easy deployment, small size, low cost, low power consumption, and ad hoc nature. Due to no additional hardware requirement and simplicity in the usage, the received signal strength indicator (RSSI) is the most widely used metric of field measurement in WSN-based L&T systems as compared with other possible metrics. However, the existing RSSI-based target tracking systems generally suffer with low tracking accuracy because of signal propagation issues such as reflection, refraction, multipath propagation, and non-line of sight (NLOS). Apart from signal propagation issues, environmental dynamicity aspects such as abrupt variations in target velocity during motion, nonavailability of all RSSI measurements, variations in target mobility patterns also make RSSI-based target L&T highly challenging. Although much research has already been done in WSN-based L&T, most of these existing systems are not robust and efficient in terms of tracking accuracy and computational complexity. The present focus of all the researchers working in RSSI and WSN-based L&T domain is the development of efficient, robust, and accurate L&T system. The research in WSN- and RSSI-based L&T domain is blooming with very high pace that it is very difficult to encompass all the new developments in it; however, we tried our best to provide a detailed review of recent and relevant information of existing RSSI- and WSN-based L&T systems. The main focus of writing this book is to give a systematic approach of learning fundamentals of WSN and its capability to build L&T applications. The sincere attempt is made in this book to answer about how to design novel-efficient RSSI-based tracking system which can track single mobile target and yield

high tracking accuracy irrespective of its motion. Several artificial neural network (ANN)-based implementations dealing with tracking of single mobile target with environmental dynamicity are presented in this book and are validated through extensive MATLAB-based simulation experiments. We believe that this book can provide an effective way to design or program customized solution tailored to meet the underlying WSN-based L&T applications with the help of RSSI measurements.

Thus through this book, we not only present the fundamentals of RF communication, WSN-based target L&T, hardware, protocols architectures, and pros-cons in the existing RSSI- and WSN-based systems, but we also present system-level implementation through MATLAB-based building blocks of subsystems of L&T system. One can use these ready-to-use building blocks to understand and build their WSN-based L&T applications or pursue further research to customize their underlying application as per the actual requirement. Any undergraduate student of physics, mathematics, computer science, or electronics disciplines might feel comfortable to follow this book material.

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About the Editors



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