

Indoor Positioning

Fouzia Elbahhar, Atika Rivenq

Indoor Positioning Nel Samama, 2019-06-21 Provides technical and scientific descriptions of potential approaches used to achieve indoor positioning, ranging from sensor networks to more advanced radio-based systems. This book presents a large technical overview of various approaches to achieve indoor positioning. These approaches cover those based on sensors, cameras, satellites, and other radio-based methods. The book also discusses the simplification of certain implementations, describing ways for the reader to design solutions that respect specifications and follow established techniques. Descriptions of the main techniques used for positioning, including angle measurement, distance measurements, Doppler measurements, and inertial measurements are also given. *Indoor Positioning: Technologies and Performance* starts with overviews of the first age of navigation, the link between time and space, the radio age, the first terrestrial positioning systems, and the era of artificial satellites. It then introduces readers to the subject of indoor positioning, as well as positioning techniques and their associated difficulties. Proximity technologies like bar codes, image recognition, Near Field Communication (NFC), and QR codes are covered—as are room restricted and building range technologies. The book examines wide area indoor positioning as well as world wide indoor technologies like High-Sensitivity and Assisted GNSS, and covers maps and mapping. It closes with the author's vision of the future in which the practice of indoor positioning is perfected across all technologies. This text: Explores aspects of indoor positioning from both theoretical and practical points of view Describes advantages and drawbacks of various approaches to positioning Provides examples of design solutions that respect specifications of tested techniques Covers infra-red sensors, lasers, Lidar, RFID, UWB, Bluetooth, Image SLAM, LiFi, WiFi, indoor GNSS, and more *Indoor Positioning* is an ideal guide for technical engineers, industrial and application developers, and students studying wireless communications and signal processing.

Indoor Positioning Nel Samama, 2019-07-11 Provides technical and scientific descriptions of potential approaches used to achieve indoor positioning, ranging from sensor networks to more advanced radio-based systems. This book presents a large technical overview of various approaches to achieve indoor positioning. These approaches cover those based on sensors, cameras, satellites, and other radio-based methods. The book also discusses the simplification of certain implementations, describing ways for the reader to design solutions that respect specifications and follow established techniques. Descriptions of the main techniques used for positioning, including angle measurement, distance measurements, Doppler measurements, and inertial measurements are also given. *Indoor*

Positioning: Technologies and Performance starts with overviews of the first age of navigation, the link between time and space, the radio age, the first terrestrial positioning systems, and the era of artificial satellites. It then introduces readers to the subject of indoor positioning, as well as positioning techniques and their associated difficulties. Proximity technologies like bar codes, image recognition, Near Field Communication (NFC), and QR codes are covered—as are room restricted and building range technologies. The book examines wide area indoor positioning as well as world wide indoor technologies like High-Sensitivity and Assisted GNSS, and covers maps and mapping. It closes with the author's vision of the future in which the practice of indoor positioning is perfected across all technologies. This text: Explores aspects of indoor positioning from both theoretical and practical points of view Describes advantages and drawbacks of various approaches to positioning Provides examples of design solutions that respect specifications of tested techniques Covers infra-red sensors, lasers, Lidar, RFID, UWB, Bluetooth, Image SLAM, LiFi, WiFi, indoor GNSS, and more Indoor Positioning is an ideal guide for technical engineers, industrial and application developers, and students studying wireless communications and signal processing.

Indoor Positioning Technologies Rainer Mautz,2012 In the age of automation the ability to navigate persons and devices in indoor environments has become increasingly important for a rising number of applications. However, we are still far away from achieving cheap provision of global indoor positioning with an accuracy of 1 meter or better. With the emergence of global satellite positioning systems, the performance of outdoor positioning has become excellent, but many mass market applications require seamless positioning capabilities in all environments. Therefore indoor positioning has become a focus of research and development during the past decade. This book categorizes all sighted indoor positioning approaches into 13 distinct technologies and describes the measuring principles of each. Individual approaches are characterized and key performance parameters are quantified.

Recent Advances in Indoor Localization Systems and Technologies Gyula Simon,László Sujbert,2021-08-30 Despite the enormous technical progress seen in the past few years, the maturity of indoor localization technologies has not yet reached the level of GNSS solutions. The 23 selected papers in this book present the recent advances and new developments in indoor localization systems and technologies, propose novel or improved methods with increased performance, provide insight into various aspects of quality control, and also introduce some unorthodox positioning methods.

Local Positioning Systems Krzysztof W. Kolodziej,Johan Hjelm,2017-12-19 Local Positioning

Systems: LBS Applications and Services explores the possible approaches and technologies to location problems including people and asset tracking, mobile resource management, public safety, and handset location-based services. The book examines several indoor positioning systems, providing detailed case studies of existing applications and their requirements, and shows how to set them up. Other chapters are dedicated to position computation algorithms using different signal metrics and determination methods, 2D/3D indoor map data and location models, indoor navigation, system components and how they work, privacy, deployment issues, and standards. In detail, the book explains the steps for deploying a location-enabled network, including doing a site-survey, creating a positioning model and floor maps, and access point placement and configuration. Also presented is a classification for network-based and ad-hoc positioning systems, and a framework for developing indoor LBS services. This comprehensive guide will be invaluable to students and lecturers in the area of wireless computing. It will also be an enabling resource to developers and researchers seeking to expand their knowledge in this field.

Indoor Wayfinding and Navigation Hassan A. Karimi, 2015-03-25 Outdoor wayfinding and navigation systems and services have become indispensable in people's mobility in unfamiliar environments. Advances in key technologies (e.g., positioning and mobile devices), has spurred interest in research and development of indoor wayfinding and navigation systems and services in recent years. Indoor Wayfinding and Navigation provides both breadth and depth of knowledge in designing and building indoor wayfinding and navigation systems and services. It covers the types of sensors both feasible and practical for localization of users inside buildings. The book discusses current approaches, techniques, and technologies for addressing issues in indoor wayfinding and navigation systems and services. It includes coverage of the cognitive, positioning, mapping, and application perspectives, an unusual but useful combination of information. This mix of different perspectives helps you better understand the issues and challenges of building indoor wayfinding and navigation systems and services, how they are different from those used outdoors, and how they can be used efficiently and effectively in challenging applications. Written by well-known specialists in the field, the book addresses all aspects of indoor wayfinding and navigation. It includes the latest research developments on the topic, succinctly covers the fundamentals, and details the issues and challenges in building new systems and services. With this information, you can design indoor wayfinding and navigation systems and services for a variety of uses and users.

Visible Light Communication Based Indoor Localization Mohsen Kavehrad, Reza

Aminikashani,2019-11-18 This book demonstrates the research on VLC based indoor localization in four aspects: first, it constructs the concept and model of the system; second, positioning algorithms, as the main issue in indoor localization, are detailed; third, many approaches are proposed to further improve the positioning performance; fourth, challenges will be detailed. Impulse response with multipath reflections are analyzed. Orthogonal frequency division multiplexing (OFDM) is proposed, and positioning performance is largely improved compared to On-off-keying (OOK) modulation. The readers will get a broad view of VLC based indoor localization from the background to the future challenges.

Indoor Positioning Gerardus Blokdyk,2018-01-16 What are the rough order estimates on cost savings/opportunities that Indoor Positioning brings? How do we keep improving Indoor Positioning? How do we measure improved Indoor Positioning service perception, and satisfaction? Who will be responsible for making the decisions to include or exclude requested changes once Indoor Positioning is underway? How can skill-level changes improve Indoor Positioning? Defining, designing, creating, and implementing a process to solve a business challenge or meet a business objective is the most valuable role... In EVERY company, organization and department. Unless you are talking a one-time, single-use project within a business, there should be a process. Whether that process is managed and implemented by humans, AI, or a combination of the two, it needs to be designed by someone with a complex enough perspective to ask the right questions. Someone capable of asking the right questions and step back and say, 'What are we really trying to accomplish here? And is there a different way to look at it?' This Self-Assessment empowers people to do just that - whether their title is entrepreneur, manager, consultant, (Vice-)President, CxO etc... - they are the people who rule the future. They are the person who asks the right questions to make Indoor Positioning investments work better. This Indoor Positioning All-Inclusive Self-Assessment enables You to be that person. All the tools you need to an in-depth Indoor Positioning Self-Assessment. Featuring 489 new and updated case-based questions, organized into seven core areas of process design, this Self-Assessment will help you identify areas in which Indoor Positioning improvements can be made. In using the questions you will be better able to: - diagnose Indoor Positioning projects, initiatives, organizations, businesses and processes using accepted diagnostic standards and practices - implement evidence-based best practice strategies aligned with overall goals - integrate recent advances in Indoor Positioning and process design strategies into practice according to best practice guidelines Using a Self-Assessment tool known as the Indoor Positioning Scorecard, you will develop a clear picture of which Indoor

Positioning areas need attention. Your purchase includes access details to the Indoor Positioning self-assessment dashboard download which gives you your dynamically prioritized projects-ready tool and shows your organization exactly what to do next. Your exclusive instant access details can be found in your book.

Mobile Positioning and Tracking Simone Frattasi,Francescantonio Della Rosa,2017-08-14 The essential guide to state-of-the art mobile positioning and tracking techniques—fully updated for new and emerging trends in the field Mobile Positioning and Tracking, Second Edition explores state-of-the-art mobile positioning solutions applied on top of current wireless communication networks. Application areas covered include positioning, data fusion and filtering, tracking, error mitigation, both conventional and cooperative positioning technologies and systems, and more. The authors fill the gap between positioning and communication systems, showing how features of wireless communications systems can be used for positioning purposes and how the retrieved location information can be used to enhance the performance of wireless networks. Unlike other books on the subject, Mobile Positioning and Tracking: From Conventional to Cooperative Techniques, 2nd Edition covers the entire positioning and tracking value chain, starting from the measurement of positioning signals, and offering valuable insights into the theoretical fundamentals behind these methods and how they relate to application areas such as location-based services, as well as related disciplines and professional concerns, including global business considerations and the changing laws and standards governing wireless communication networks. Fully updated and revised for the latest developments in the field, this Second Edition: Features new chapters on UWB positioning and tracking, indoor positioning in WLAN, and multi-tag positioning in RFID Explores an array of positioning and tracking systems based on satellite and terrestrial systems technologies and methods Introduces advanced and novel topics such as localisation in heterogeneous and cooperative scenarios Provides a bridge between research and industry with potential implementations of the solutions presented Mobile positioning and tracking is subject to continuous innovations and improvements. This important working resource helps busy industry professionals and practitioners—including software and service developers—stay on top of emerging trends in the field. It is also a valuable reference for advanced students in related disciplines studying positioning and mobile technologies.

Indoor Location Technologies Subrata Goswami,2012-07-25 Focusing on the special challenges posed by accurately pinpointing a location indoors, this volume reflects the distance we have come in the handful of decades since the germination of GPS technology. Not only can we locate a signal to

within a meter's accuracy, but we now have this technology in the most basic mobile phone. Tracing recent practical developments in positioning technology and in the market it supplies, the author examines the contributions of the varied research—in silicon, signal and image processing, radio communications and software—to a fast-evolving field. The book looks forward to a time when, in addition to directing your road journey, positioning systems can peer indoors and guide you to an available photocopier in your office building. Featuring standalone chapters each dealing with a specific aspect of the subject, including treatments of systems such as Zebra, Awarepoint, Aeroscout, IEEE 802.11, etc. This study has all the detail needed to get up to speed on a key modern technology.

Indoor Location-Based Services Martin Werner, 2014-11-29 This book delivers concise coverage of classical methods and new developments related to indoor location-based services. It collects results from isolated domains including geometry, artificial intelligence, statistics, cooperative algorithms, and distributed systems and thus provides an accessible overview of fundamental methods and technologies. This makes it an ideal starting point for researchers, students, and professionals in pervasive computing. Location-based services are services using the location of a mobile computing device as their primary input. While such services are fairly easy to implement outside buildings thanks to accessible global positioning systems and high-quality environmental information, the situation inside buildings is fundamentally different. In general, there is no simple way of determining the position of a moving target inside a building without an additional dedicated infrastructure. The book's structure is learning oriented, starting with a short introduction to wireless communication systems and basic positioning techniques and ending with advanced features like event detection, simultaneous localization and mapping, and privacy aspects. Readers who are not familiar with the individual topics will be able to work through the book from start to finish. At the same time all chapters are self-contained to support readers who are already familiar with some of the content and only want to pick selected topics that are of particular interest.

INDOOR POSITIONING HANDBK - EV James Beach, 2016-11-08 This book is your ultimate Indoor Positioning resource. Here you will find the most up-to-date information, facts, quotes and much more. In easy to read chapters, with extensive references and links to get you to know all there is to know about Indoor Positioning's whole picture right away. Get countless Indoor Positioning facts right at your fingertips with this essential resource. The Indoor Positioning Handbook is the single and largest Indoor Positioning reference book. This compendium of information is the authoritative source for all your entertainment, reference, and learning needs. It will be your go-to source for any Indoor

Positioning questions. A mind-tickling encyclopedia on Indoor Positioning, a treat in its entirety and an oasis of learning about what you don't yet know...but are glad you found. The Indoor Positioning Handbook will answer all of your needs, and much more.

New Approach of Indoor and Outdoor Localization Systems Fouzia Elbahhar,Atika

Rivenq,2012-10-10 Accurate determination of the mobile position constitutes the basis of many new applications. This book provides a detailed account of wireless systems for positioning, signal processing, radio localization techniques (Time Difference Of Arrival), performances evaluation, and localization applications. The first section is dedicated to Satellite systems for positioning like GPS, GNSS. The second section addresses the localization applications using the wireless sensor networks. Some techniques are introduced for localization systems, especially for indoor positioning, such as Ultra Wide Band (UWB), WIFI. The last section is dedicated to Coupled GPS and other sensors. Some results of simulations, implementation and tests are given to help readers grasp the presented techniques. This is an ideal book for students, PhD students, academics and engineers in the field of Communication, localization

Indoor Positioning Gerard Blokdyk,2017-10-22 What are the compelling business reasons for embarking on Indoor Positioning? How do we go about Comparing Indoor Positioning approaches/solutions? What are the revised rough estimates of the financial savings/opportunity for Indoor Positioning improvements? Will team members regularly document their Indoor Positioning work? How are the Indoor Positioning's objectives aligned to the organization's overall business strategy? Defining, designing, creating, and implementing a process to solve a business challenge or meet a business objective is the most valuable role... In EVERY company, organization and department. Unless you are talking a one-time, single-use project within a business, there should be a process. Whether that process is managed and implemented by humans, AI, or a combination of the two, it needs to be designed by someone with a complex enough perspective to ask the right questions. Someone capable of asking the right questions and step back and say, 'What are we really trying to accomplish here? And is there a different way to look at it?' For more than twenty years, The Art of Service's Self-Assessments empower people who can do just that - whether their title is marketer, entrepreneur, manager, salesperson, consultant, business process manager, executive assistant, IT Manager, CxO etc... - they are the people who rule the future. They are people who watch the process as it happens, and ask the right questions to make the process work better. This book is for managers, advisors, consultants, specialists, professionals and anyone interested in Indoor

Positioning assessment. All the tools you need to an in-depth Indoor Positioning Self-Assessment. Featuring 489 new and updated case-based questions, organized into seven core areas of process design, this Self-Assessment will help you identify areas in which Indoor Positioning improvements can be made. In using the questions you will be better able to: - diagnose Indoor Positioning projects, initiatives, organizations, businesses and processes using accepted diagnostic standards and practices - implement evidence-based best practice strategies aligned with overall goals - integrate recent advances in Indoor Positioning and process design strategies into practice according to best practice guidelines Using a Self-Assessment tool known as the Indoor Positioning Scorecard, you will develop a clear picture of which Indoor Positioning areas need attention. Included with your purchase of the book is the Indoor Positioning Self-Assessment downloadable resource, which contains all questions and Self-Assessment areas of this book in a ready to use Excel dashboard, including the self-assessment, graphic insights, and project planning automation - all with examples to get you started with the assessment right away. Access instructions can be found in the book. You are free to use the Self-Assessment contents in your presentations and materials for customers without asking us - we are here to help.

Indoor Positioning and Navigation Simon Toma, 2021

Machine Learning for Indoor Localization and Navigation Saideep Tikur, Sudeep

Pasricha, 2023-06-29 While GPS is the de-facto solution for outdoor positioning with a clear sky view, there is no prevailing technology for GPS-deprived areas, including dense city centers, urban canyons, buildings and other covered structures, and subterranean facilities such as underground mines, where GPS signals are severely attenuated or totally blocked. As an alternative to GPS for the outdoors, indoor localization using machine learning is an emerging embedded and Internet of Things (IoT) application domain that is poised to reinvent the way we navigate in various indoor environments. This book discusses advances in the applications of machine learning that enable the localization and navigation of humans, robots, and vehicles in GPS-deficient environments. The book explores key challenges in the domain, such as mobile device resource limitations, device heterogeneity, environmental uncertainties, wireless signal variations, and security vulnerabilities. Countering these challenges can improve the accuracy, reliability, predictability, and energy-efficiency of indoor localization and navigation. The book identifies several novel energy-efficient, real-time, and robust indoor localization techniques that utilize emerging deep machine learning and statistical techniques to address the challenges for indoor localization and navigation. In particular, the book: Provides

comprehensive coverage of the application of machine learning to the domain of indoor localization; Presents techniques to adapt and optimize machine learning models for fast, energy-efficient indoor localization; Covers design and deployment of indoor localization frameworks on mobile, IoT, and embedded devices in real conditions.

The Present and Future of Indoor Navigation Laura Ruotsalainen, Martti Kirkko-Jaakkola, Jukka Talvitie, 2023-11-30 *The Present and Future of Indoor Navigation* provides a complete overview of the latest indoor navigation technologies, algorithms, and systems. It begins by discussing various types of sensors that can be used for indoor navigation, such as accelerometers, gyroscopes, barometers, magnetometers, and cameras. It covers the numerous algorithms that can be used to compute the navigation solution, including Kalman filtering, particle filtering, and machine learning. Also, it discusses the system implementation considerations for indoor navigation, such as infrastructure, data fusion, and security. The book's focus is on present technologies and algorithms, as well as providing a look into the future possibilities for indoor navigation, making it a great resource for a wide audience. This includes researchers, engineers, and students who are interested in indoor navigation. It is also a valuable resource for anyone who wants to learn more about the latest technologies and algorithms for indoor navigation.

Geographical and Fingerprinting Data for Positioning and Navigation Systems Jordi Conesa, Antoni Pérez-Navarro, Joaquin Torres-Sospedra, Raul Montoliu, 2018-10-06 *Geographical and Fingerprinting Data for Positioning and Navigation Systems: Challenges, Experiences and Technology Roadmap* explores the state-of-the-art software tools and innovative strategies to provide better understanding of positioning and navigation in indoor environments using fingerprinting techniques. The book provides the different problems and challenges of indoor positioning and navigation services and shows how fingerprinting can be used to address such necessities. This advanced publication provides the useful references educational institutions, industry, academic researchers, professionals, developers and practitioners need to apply, evaluate and reproduce this book's contributions. The readers will learn how to apply the necessary infrastructure to provide fingerprinting services and scalable environments to deal with fingerprint data. Provides the current state of fingerprinting for indoor positioning and navigation, along with its challenges and achievements Presents solutions for using WIFI signals to position and navigate in indoor environments Covers solutions for using the magnetic field to position and navigate in indoor environments Contains solutions of a modular positioning system as a solution for seamless positioning Analyzes geographical and fingerprint data in order to provide indoor/outdoor

location and navigation systems

Design and Development of Indoor Positioning System Muhammad Irshan Khan, 2013 Indoor positioning and navigation in smart phones has become possible with the availability of good processors, sensors and connectivity in smart phone. The development of a system that utilizes these technologies for indoor positioning has been discussed. This system integrates wifi positioning, inertial sensors' data and buildings' map information for indoor navigation. Micro electromechanical systems (MEMS) based gyroscopes and accelerometers, have been used for providing pedestrian dead reckoning; and a Bayesian filter based on Monte Carlo simulation (particle filter) has been designed for integration of wifi positioning, pedestrian dead reckoning and buildings' map information for indoor navigation. This filter provides the state of the user estimated as a weighted mean of the approximated distribution obtained from particle filter. The positioning system has been built with XSENS MTW IMU, Acer ICONIA tablet running MATLAB. The developed system provides indoor positioning with mean square error within 1 meter, the error value of less than 2.5 m 95% of the time with the consistency of 96.86%.

Wireless Indoor Localization Chenshu Wu, Zheng Yang, Yunhao Liu, 2018-08-22 This book provides a comprehensive and in-depth understanding of wireless indoor localization for ubiquitous applications. The past decade has witnessed a flourishing of WiFi-based indoor localization, which has become one of the most popular localization solutions and has attracted considerable attention from both the academic and industrial communities. Specifically focusing on WiFi fingerprint based localization via crowdsourcing, the book follows a top-down approach and explores the three most important aspects of wireless indoor localization: deployment, maintenance, and service accuracy. After extensively reviewing the state-of-the-art literature, it highlights the latest advances in crowdsourcing-enabled WiFi localization. It elaborated the ideas, methods and systems for implementing the crowdsourcing approach for fingerprint-based localization. By tackling the problems such as: deployment costs of fingerprint database construction, maintenance overhead of fingerprint database updating, floor plan generation, and location errors, the book offers a valuable reference guide for technicians and practitioners in the field of location-based services. As the first of its kind, introducing readers to WiFi-based localization from a crowdsourcing perspective, it will greatly benefit and appeal to scientists and researchers in mobile and ubiquitous computing and related areas.

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Indoor Positioning Introduction

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