Imagine that your refrigerator can tell you if the food it contains is going bad, or that the clothes you wear can tell your thermostat when to change the temperature in a room. This may seem like the technology of science fiction novels, however, researchers in ubiquitous computing propose this sort of technology and more. Ubiquitous computing is a forward-looking research area which focuses on the integration of technology into everyday life with the end goal of making the technology second nature and nearly, if not completely, invisible to the user. This technology represents a movement away from the current second generation desktop model, in which the user’s interaction with the technology is intentional and deliberate, to a third generation computing model in which the user may engage several technologies at once, possibility without being aware of the interaction.

As the world moves closer and closer to the integration of technology into every aspect of life there is a greater need for innovative research and development into the various aspects of ubiquitous computing. Issues surrounding ubiquitous and pervasive computing vary from the practical questions of hardware size and user interfacing to the more ethical questions of privacy and data protection. Every aspect of how users interact with technology and what role technology should play in the world is constantly being reviewed, revised, and updated in light of the ubiquitous computing movement. With such continual change it is important for researchers and practitioners in this field to stay abreast of the latest in technological and theoretical advances.

With the constant changes in the landscape of ubiquitous and pervasive computing it is a challenge for researchers and experts to take in the volume of innovative advances and up-to-the-moment research in this multifarious field. Information Science Reference is pleased to offer a three-volume reference collection on this rapidly growing discipline, in order to empower students, researchers, academicians, and practitioners with a wide-ranging understanding of the most critical areas within this field of study. This collection provides the most comprehensive, in-depth, and recent coverage of all issues related to the development of cutting-edge ubiquitous technologies, as well as a single reference source on all conceptual, methodological, technical and managerial issues, and the opportunities, future challenges and emerging trends related to the development of the ubiquitous and pervasive computing model.

This collection entitled, “Ubiquitous and Pervasive Computing: Concepts, Methodologies, Tools, and Applications” is organized in eight (8) distinct sections, providing the most wide-ranging coverage of topics such as: 1) Fundamental Concepts and Theories; 2) Development and Design Methodologies; 3) Tools and Technologies; 4) Utilization and Application; 5) Organizational and Social Implications; 6) Managerial Impact; 7) Critical Issues; and 8) Emerging Trends. The following provides a summary of what is covered in each section of this multi-volume reference collection:

Section 1, Fundamental Concepts and Theories, serves as a foundation for this extensive reference tool by addressing crucial theories essential to the understanding of ubiquitous and pervasive computing.
Chapters such as, “Introduction to Ubiquitous Computing,” by Max Mühlhäuser and Iryna Gurevych, as well as “Ubiquitous Computing History, Development, and Scenarios,” by Jimmy Chong, Stanley See, Lily Leng-Hiang Seah, Sze Ling Koh, Yin-Leng Theng and Henry B. L. Duh, provide foundational information on the history of and important topics related to ubiquitous computing. “Understanding RFID (Radio Frequency Identification),” by Susan A. Vowels, presents an explanation of RFID technology and describes how this technology can improve upon the limitations of the barcode system which is already pervasively used for identifying objects. Fariba Sadri and Kostas Stathis present a foundational review of the progress of ambient intelligence research and discuss the role of this technology for independent living in their chapter “Ambient Intelligence.” Ubiquitous computing, pervasive computing, and context computing as they relate to e-commerce are discussed in “Context Related Software Under Ubiquitous Computing” by N. Raghavendra Rao. “Ethical Issues and Pervasive Computing,” by Penny Duquenoy and Oliver K. Burmeister, emphasizes the need for an ethical perspective on the implementation of pervasive technologies and describes a code of professional conduct for consideration while designing and implementing ubiquitous technology. These and several other foundational chapters provide a wealth of expert research on the elemental concepts and ideas which surround the ubiquitous and pervasive computing models.

Section 2, Development and Design Methodologies, presents in-depth coverage of conceptual design and architecture to provide the reader with a comprehensive understanding of the emerging technological developments within the field of ubiquitous computing. “Multimodal Software Engineering,” by Andreas Hartl, and “Designing Pervasive and Multimodal Interactive Systems: An Approach Built on the Field,” by Barbara R. Barricelli, Andrea Marcante, Piero Mussio, Loredana Parasiliti Provenza, Marco Padula and Paolo L. Scala, discuss the importance of multimodal technology for pervasive computing and present recommended approaches for the development of these technologies. Heinz-Josef Eikerling and Pietro Mazzoleni present a holistic methodology for the development of context-aware mobile services in their chapter “A Methodology for the Design, Development and Validation of Adaptive and Context-Aware Mobile Services,” while René Meier and Deirdre Lee discuss the iTransIT framework which ultimately leads to a method for creating context-aware ambient services in their chapter “Context-Aware Services for Ambient Environments.” From chapters covering a broad description of developmental concepts, such as Varuna Godara’s “Pervasive Computing: A Conceptual Framework,” to chapters describing the use of pervasive technologies to deal with a specific question, as in “A Mandarin E-Learning System in Pervasive Environment” by Yue Ming and Zhenjiang Miao, this section provides a vast array of methods and approaches to designing relevant and useful ubiquitous technologies. With more than 20 contributions from leading international researchers, this section offers copious developmental approaches and methodologies for ubiquitous and pervasive computing.

Section 3, Tools and Technologies, presents extensive coverage of the various tools and technologies used in the development and implementation of ubiquitous and pervasive technologies. This comprehensive section includes chapters such as “An Intelligent Wearable Platform for Real Time Pilot’s Health Telemonitoring,” by Christos Papadelis, Chrysoula Kourtidou-Papadeli, Fotini Lazaridou and Eleni Perantoni, as well as “A SCORM Compliant Courseware Authoring Tool for Supporting Pervasive Learning,” by Te-Hua Wang and Flora Chia-I Chang, which describe pervasive technologies developed with niche specific practical uses in mind. “Ubiquitous Computing Technologies in Education,” by Gwo-Jen Hwang, Ting-Ting Wu and Yen-Jung Chen, describes potential issues surrounding the implementation of ubiquitous and mobile technologies in e-learning. The EMURCT system to assist with randomizing circuit training programs in an effort to keep trainees from becoming bored with their workout is described in “Electronic Multi-User Randomized Circuit Training For Workout Motivation” by Corey
A. Graves, Sam Muldrew, Tiara Williams, Jerono Rotich and Eric A. Cheek. Authors Artur Lugmayr, Alexandra Pohl, Max Müehhäusser, Jan Kallenbach and Konstantinos Chorianopoulos describe ubiquitous technology for domestic use in home entertainment systems in their chapter “Ambient Media and Home Entertainment.” With more than a dozen additional contributions, this section provides coverage of a variety of tools and technologies under development and in use in the ubiquitous and pervasive technologies community.

Section 4, Utilization and Application, describes the implementation and use of an assortment of cutting edge ubiquitous technologies. Including more than 25 chapters such as “Motorola’s Experiences in Designing the Internet of Things,” by Andreas Schaller and Katrin Mueller, and “To Connect and Flow in Seoul: Ubiquitous Technologies, Urban Infrastructure and Everyday Life in the Contemporary Korean City,” by Jaz Hee-Jeong Choi and Adam Greenfield, this section provides insight into the application of ubiquitous technologies for both professional and private use. “Using RFID to Track and Trace High Value Products: The Case of City Healthcare,” by Judith A. Symonds and David Parry, describes the replacement of barcodes with RFID tags by City Healthcare of New Zealand and the implications, benefits, issues and challenges associated with that change. The application of ubiquitous technology to the healthcare field is also discussed in “An Ambient Intelligence Based Multi-Agent System for Alzheimer Health Care,” by Dante I. Tapia and Juan M. Corchado, as well as “RFID as the Critical Factor for Superior Healthcare Delivery,” by A. Dwivedi and T. Butcher. The practical use of handheld devices for accessing digital library materials is described in “Handhelds for Digital Libraries” by Spyros Veronikis, Giannis Tsakonas and Christos Papatheodorou. Contributions found in this section provide comprehensive coverage of the practicality and present use of ubiquitous technologies.

Section 5, Organizational and Social Implications, includes chapters discussing the impact of ubiquitous technology on social and organization practices. Chapters such as “Consumer Attitudes toward RFID Usage,” by Madlen Boslau and Britta Lietke, as well as “Adapting to the User,” by Matthias Jöst, focus on the attitude and acceptance of individuals interacting with and using ubiquitous technologies. “How Research can Help to Create Commercially Successful Ubiquitous Services,” by Teea Palo, Kaisa Koskela, Timo Koivumäki and Jaana Tähtinen, stresses the importance of research to the implementation and successful marketing of ubiquitous services. The impact of ubiquitous technology on education and learning environments is discussed in chapters such as “Collaborative Technology Impacts in Distributed Learning Environments,” by Martha Grabowski, Greg Lepak and George Kulick, and “Learning by Pervasive Gaming: An Empirical Study,” by Christian Kittl, Franciska Edegger and Otto Petrovic. B.K. Mangaraj and Upali Aparajita, in their chapter “Cultural Dimension in the Future of Pervasive Computing,” advocate the importance of a cultural focus when considering the introduction of a ubiquitous technology in order for the technology to be accepted and successful.

Section 6, Managerial Impact, presents a focused coverage of ubiquitous computing as it relates to improvements and considerations in the workplace. Varuna Godara’s chapter “Pervasive Business Infrastructure: The Network Technologies, Routing and Security Issues” provides an overview of pervasive business technology and discusses related business concerns such as confidentiality and authenticity. “Intelligent Supply Chain Management with Automatic Identification Technology,” by Dong Li, Xiaojun Wang, Kinchung Liu and Dennis Kehoe, proposes RFID-enabled business models for implementation in supply chain management. Also focusing on the application of ubiquitous technology to supply chain management is “RFID and Supply Chain Visibility” by Sumeet Gupta, Miti Garg, Heng Xu and Mark Goh, which discusses the adoption of RFID technology for supply chain visibility while reviewing related issues. J. Ramsay, M. Hair and K. V. Renaud in their chapter, “Ubiquitous Connectivity & Work-Related Stress,” present a study of e-mail usage by workers and describe their findings in relation to the changes in work place stressors over the last 25 years.
Section 7, Critical Issues, addresses vital issues related to the ubiquitous computing model such as privacy, access control, and data protection, among others. Chapters such as Denis Trček’s “Security and Privacy in RFID Based Wireless Networks” and “Privacy Issues of Applying RFID in Retail Industry,” by Haifei Li, Patrick C. K. Hung, Jia Zhang and David Ahn, tackle the difficult question of privacy and data security for the application of RFID technology. In “Invisibility and Visibility: The Shadows of Artificial Intelligence,” by Cecile K. M. Crutzen and Hans-Werner Hein, the authors discuss the construction of new meanings relating to human computer interaction as the visible action of users will be both preceded and followed by the invisible action of intelligent technology. “Pervasive and Ubiquitous Computing Databases: Critical Issues and Challenges,” by Michael Zouboulakis and George Roussos, provides an explanation of the importance of databases to the ubiquitous and pervasive computing movements. Ambient information displays and issues related to their evaluation are discussed in “Issues for the Evaluation of Ambient Displays” by Xiaobin Shen, Andrew Vande Moere, Peter Eades and Seok-Hee Hong. The chapter “IPML: Structuring Distributed Multimedia Presentations in Ambient Intelligent Environments,” by Jun Hu and Loe Feijs, discusses the IPML markup language as an answer to issues relating to distributing multimedia presentations in ambient intelligent environments. These and other chapters in this section combine to provide a lively review of those issues which are most important to ubiquitous and pervasive computing technologies.

The concluding section of this authoritative reference tool, Emerging Trends, highlights areas for future research within the field of ubiquitous computing, while exploring new avenues for the advancement of the technology. Jong-Sung Hwang’s chapter, “u-City: The Next Paradigm of Urban Development,” describes South Korea’s u-City project. The project is based on an emerging concept that uses ubiquitous technology to provide innovative urban services. “Voices from Beyond: Ephemeral Histories, Locative Media and the Volatile Interface,” by Barbara Crow, Michael Longford, Kim Sawchuk and Andrea Zeffiro, describes the emerging technology and theories used by the Mobile Media Lab in two of their recent projects. José Rouillard describes his research into the delivery of content via heterogeneous networks and devices resulting in the adaptive pervasive learning environment PerZoovasive. The description and results of his research project can be found in the chapter “Plastic Interfaces for Ubiquitous Learning.” The state of research into next generation Internet and telecommunications technologies, as they relate to a variety of research projects such as Future House 2015, can be found in the chapter “From E to U: Towards an Innovative Digital Era” by Spyros P. Angelopoulos, Fotis C. Kitsios and Eduard Babulak. In his chapter “Life in the Pocket: The Ambient Life Project Life-Like Movements in Tactile Ambient Displays in Mobile Phones,” Fabian Hemmert presents the results of his study in which ambient displays are used to notify users of missed events on their mobile phones. These and several other emerging trends and suggestions for future research can be found within the final section of this exhaustive multi-volume set.

Although the primary organization of the contents in this multi-volume work is based on its eight sections, offering a progression of coverage of the important concepts, methodologies, technologies, applications, social issues, and emerging trends, the reader can also identify specific contents by utilizing the extensive indexing system listed at the end of each volume. Furthermore to ensure that the scholar, researcher and educator have access to the entire contents of this multi volume set as well as additional coverage that could not be included in the print version of this publication, the publisher will provide unlimited multi-user electronic access to the online aggregated database of this collection for the life of the edition, free of charge when a library purchases a print copy. This aggregated database provides far more contents than what can be included in the print version in addition to continual updates. This unlimited access, coupled with the continuous updates to the database ensures that the most current research is accessible to knowledge seekers.
Although the concept of ubiquitous and pervasive computing may once have been the imaginative fodder of science fiction writers and readers alike, it is fast becoming a technological reality. This model of computing continues to grow and thrive as researchers and practitioners rethink the way that we interact with and understand the role of technology in everyday life. As ubiquitous technology becomes more and more of a reality, the demand for thorough integration, smaller hardware, and thoroughly invisible technology will continue to grow. The move from second generation desktop computing to the third generation ubiquitous model is certain to increase the demand for greater improvements and cutting edge research in RFID, ambient intelligence, and other areas related to the advancement of ubiquitous computing. Access to the most up-to-date research findings and firm knowledge of proven techniques and models from other researchers and practitioners of the ubiquitous computing model will facilitate the discovery and invention of increasingly more effective methods and technologies.

The diverse and comprehensive coverage of ubiquitous and pervasive computing in this three-volume authoritative publication will contribute to a better understanding of all topics, research, and discoveries in this developing, significant field of study. Furthermore, the contributions included in this multi-volume collection series will be instrumental in the expansion of the body of knowledge in this enormous field, resulting in a greater understanding of the fundamental concepts and technologies while fueling the research initiatives in emerging fields. We at Information Science Reference, along with the editor of this collection and the publisher, hope that this multi-volume collection will become instrumental in the expansion of the discipline and will promote the continued growth of all aspects of ubiquitous and pervasive computing.