Preface

The book “Ubiquitous and Pervasive Computing: New Issues and Trends” has as overall objective to clarify the new technologies, applications and researches in the ubiquitous and pervasive computing area. It intends to help students, teachers and researchers to obtaining a larger understanding of both the potential of the related technologies and the trends that are being followed to make ubiquitous and pervasive computing more effective.

The implementation of ubiquitous and pervasive computing is not a trivial task. The accumulated experience and know-how of the researchers in this area, which have invested time and effort in study in the attempt of solving problems in this area, are, therefore, important success factors. This book shares this know-how with other researchers, students and interested professionals in this area. It shows the current trends, practices and challenges faced by designers of ubiquitous and pervasive computing projects. These includes from theoretical assumptions and empirical researches to practical implementations and case studies. In the end, the readers have a clear notion about which is the actual stage and which are the future tendencies in this area.

The book “Ubiquitous and Pervasive Computing: New Issues and Trends” is very valuable to researchers and teachers working in both areas ubiquitous computing and pervasive computing. ubiquitous and pervasive computing is a genuinely interdisciplinary area that strives for creating a better comprehension of the requirements of mobile architectures that is mediated by a diverse set of computer technologies. Therefore, this book is addressed to a wide audience, including researchers and students, educators and industrial trainers interested in various disciplines, such as network sensors, embedded systems, distributed systems, computer networks and, mainly, computer science. Given its depth and breadth of coverage, this book is also of interest to a wide audience of researchers in the fields of electrical engineering, as well as computer science. It is helpful for scholars and business professionals entrusted for implementation of mobile devices and ubiquitous and pervasive applications. The major scholarly value of this book is to provide a general overview about researches on ubiquitous and pervasive computing and its applications, as well as a notion about the recent progress in works in this area. This overview support future academic researches with the background provided by the experts in this book. Also, it points out to scholars what they should do (best practices) and should not do (bad practices).

In relation to the contribution to information science, technology and management literature, one important improvement, which can be provided by this book, is the discussion about new methodologies, technologies and approaches that are being used in ubiquitous and pervasive computing and their advantages and challenges. The topics covered in this book, which include the current best practices in ubiquitous and pervasive computing, can also stimulate the implementation and the use of the related technologies in academic and industrial context. In addition, this book serves to highlight some of the most important gaps in the development of ubiquitous and pervasive computing support tools, patterns of development, and so forth.
The book is organized in fifteen chapters. In the following we give a brief description of each of the chapters that comprise this book.

Chapter 1, by Nirmalya Roy and Sajal K. Das, discusses managing context uncertainty in smart pervasive environments. The authors specifically discuss a novel game theoretic learning and prediction framework that attempts to minimize the joint location uncertainty of inhabitants in multi-inhabitant smart homes. This results in more accurate prediction of contexts and more adaptive control of automated devices, thus leading to a mobility-aware resource management scheme in multi-inhabitant smart homes.

Chapter 2, by Leili Lind, Aseel Berglund, Erik Berglund, Magnus Bång and Sture Hägglund, reviews existing technologies and refer a number of exemplifying applications together with studies and evaluations of their usability, which show a promising degree of user acceptance and convenience. The practical use of digital pen and paper technology is discussed with applications demonstrating its appropriateness in home care for elderly, for free-form recording of data on paper such as maps and sketches, and as a remote control for a TV set or other electronic appliances with rich functionality in the home.

Chapter 3, by Valéria Farinazzo Martins Salvador, João Soares de Oliveira Neto and Marcelo de Paiva Guimarães, describes a study on the evaluation of Voice User Interface (VUI) in Ubiquitous Applications and discusses some of issues which may impact the evaluation process when using the voice as a natural way of interacting with computers. We present a set of guidelines and usability principles that should be considered when developing VUIs for Ubiquitous Applications and a case study in order to test and exemplify the concepts presented in this chapter.

In Chapter 4, Ricardo A. Rabelo Oliveira and Antônio Alfredo Ferreira Loureiro present a framework to a service that acts as a middleware to the applications, providing the information about the wireless network context. The increasing use of wireless communications in mobile devices calls for a new level of resource management. Users with mobile devices accessing wireless hot spots are a commonplace, and, thus, their management is becoming more important.

Chapter 5, by José Cano, Juan-Carlos Cano, Carlos T. Calafate and Pietro Manzoni, describes a set of prototype applications developed in the field of ubiquitous and pervasive computing. The aim is, firstly improve several real environments from the point of view of the user and the environment itself, and secondly to extend the use of such applications to the greatest number of environments and potential users, since the benefits obtained are quite remarkable. The developed prototypes are based on personal area networks (PANs) and mobile ad hoc networks (MANETs) and make use of wireless technologies like Wi-Fi and Bluetooth.

In Chapter 6, Mitun Bhattacharyya, Ashok Kumar and Magdy Bayoumi propose methodologies for improving the efficiency of a control system in an industrial environment, specifically an oil production platform. They propose a data fusion model that consists of four steps – preprocessing, classification and association, data association and correlation association, and composite decision. The first two steps are executed at the sensor network level and the last two steps are done at the network manager or controller level. The second proposal is a distributed hierarchical control system and network management system. Here the central idea is that the network manager and controller coordinate in order to make delays in feedback loops as well as for increasing the lifetime of the sensor network. They finally conclude the control system proposal by giving a controlling model using sensor networks to control the flow of hydrocarbons in an oil production platform.

Chapter 7, by Mitun Bhattacharyya, Ashok Kumar and Magdy Bayoumi, proposes a system based on the WirelessHART standard for monitoring and controlling oil platforms using sensor networks. It propose a hierarchical distributed system where sensor nodes and process components are grouped both functionally and in terms of proximity (i.e., spatially). The authors harness the existing electrical powering supplies to some of the process components to enhance our network routing protocol. They
also propose a component based addressing scheme. Then propose a hybrid routing protocol having proactive paths for high priority data and reactive paths for low priority that can help in load balancing and thus improving the lifetime of the sensor network. Finally, they discuss about methodologies for assessing the health (residual energy) of the sensor network system. Related research is discussed at appropriate points.

In Chapter 8, Robert Tesch, Ashok Kumar, Jamie Mason, Dania Alvarez, Mario Di’Mattia and Shawn Luce introduce the motivation for low power design considerations by discussing the power limitations of ubiquitous computing devices. Then these authors discuss the research directions that are being pursued in literature for reducing power consumption and increasing efficiency of ubiquitous computing systems.

Chapter 9, by João B. Borges Neto, Rossana M. C. Andrade and Pedro Fernandes Ribeiro Neto, discusses how the advances of the Wireless Sensor Networks may be useful to assist in the development and creation of smart environments, essential to the ubiquitous computing can become real and present in our everyday life.

In Chapter 10, Rachid Kadouche and Bessam Abdulrazak discuss an approach to manage the human environment interaction in case of disability. It provides accessible services to the user in smart environment. This approach is based on the user limitation capabilities (“handicap situations”) in smart environment presenting a technical model, which could be handled by any technological system, based on clinical, sociological, and usage analysis studies in the field of assistive technologies and quantified the users and environment characteristics and formalized the relationship between the user’s physical parameters and the technical parameters of the environment under a semantic framework which brings out the handicap situation for each user in a given environment which allow him to identify the accessible services in this environment.

In Chapter 11, Kenji Tei, Shunichiro Suenaga, Yoshiyuki Nakamura, Yuichi Sei, Hikotoshi Nakazato, Yoichi Kaneki, Nobukazu Yoshioka, Yoshiaki Fukazawa and Shinichi Honiden show research issues related to open wireless sensor network (WSN) from the viewpoints of task description language, runtime task management, self-adaptability, and security, and introduce XAC project which is a research project to develop a middleware for open WSN.

Chapter 12, by Thienne Johnson, Eleri Cardozo and Eliane Gomes Guimarães, provides an overview of pervasive computing environments for eHealth applications. The most common applications and some technologies to provide pervasive computing environment to collect information for the eHealth applications are described. Some challenge issues such as security, use of context, user acceptance and performance requirements are presented.

Chapter 13, by Carlos Maurício Serôdio Figueiredo and Antonio Alfredo Ferreira Loureiro, presents an overview of self-organizing networks, introduces important functions and techniques applied to Ad Hoc Networks, and focuses on important design aspects that can be useful to new designs.

In Chapter 14, Andrey V. Gavrilov applies an hybrid approach to development of intelligent systems to ubiquitous computing systems, in particular, to smart environment. Different classifications of Hybrid Intelligent Systems (HIS) are looking and two examples of hybrid approach for smart environment are suggested: framework based on expert system and neural network for programming of behavior of smart objects and paradigm of context-based programming-learning of behavior of intelligent agent. Besides this chapter offers an attempt to systematize concepts for development of HIS as any introduction to methodology for development of HIS is suggested. Author hopes that this chapter will be useful for researchers and developers to better understand challenges in development of ambient intelligence and possible ways to overcome them.
In Chapter 15, Cristiano André da Costa, Jorge Luis Victoria Barbosa, Luciano Cavalheiro da Silva, Adenauer Corrêa Yamin and Cláudio Fernando Resin Geyer review essential concepts of the ubiquitous computing area, its evolution, and challenges that must be managed. To deal with these issues, the authors describe the main requirements for the development of ubiquitous software. This analysis starts with the discussion of limitations in the use of traditional programming models, and then goes on to the proposition of techniques to address these limitations.

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