

Ambient Intelligence

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Ambient Intelligence

With 143 Figures

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Preface

The emergence of a new technical concept that profoundly affects human life is a relatively rare event. Yet, over the last centuries and decades, we have witnessed acceleration in the introduction of new society-affecting technologies. While it took a long time for book printing, electricity, the car and television to put their stamp on the world and to affect the daily living patterns, information-technology related technologies have been introduced at an ever-increasing pace. It took the internet and the mobile phone just two or one decades to profoundly change the way we communicate and interact.

It is our belief that yet another paradigm-shifting technology is now on the horizon. “Ambient intelligence” is the most commonly used descriptor of the phenomenon, although in the United States it is often dubbed as sensor (and actuator) networks. As a third wave of computing, it presents a true departure from the way electronic devices and humans interact. In the first wave of computing – mainframes, super-computers, mini-computers, desk-and laptops, the meaning of computation was centered in a single device, and users mostly interacted in batch-mode or through a limited interface. With the advent of the internet and the world-wide web in the 1990s, the picture changed dramatically. Computation and information access became a globally distributed concept with data and computation scattered over a wide range of servers and data storage devices located all over the world. However, the interface remained quite similar to the previous era. To obtain data or information, a user has to proactively initiate an exchange.

The “Ambient Intelligence” paradigm differs in two major ways from these previous generations. First of all, the user interface has become reactive, that is actions are not explicitly requested but are the result of the mere presence of people or their avatars (of course, with their explicit or implicit goals and constraints). Secondly, the meaning of computation can no longer be associated to a single device or a set of connected devices, but is located in the “collection of devices”. This means that the failure of a single component does not mean that the goal cannot be accomplished.

Yet, new technologies do not appear all of a sudden. After initially being in the domain of a mere few (just think about the ARPANET of the 1970s and early 1980s), they gradually emerge into the global market. For this to happen, potential users have to be prepared, convincing benefits have to be

conveyed, and concerns regarding negative side-effects have to be resolved. “Ambient Intelligence” is such a new concept. To be successful, it is up to the advocates of this vision to preach: that is, to make it known, provide understanding, create demands, shine light onto the concept from various angles, and discuss various peripheral aspects. Only when this is accomplished will the technology find broader penetration and begin to accelerate.

These concerns provided the ultimate motivation for the editors to assemble this book. As true believers, it is our goal to “preach”: convey the opportunities and benefits of the ambient intelligence concept, evaluate the current status and identify challenges and concerns.

To that effect, we have organized the book in three major parts:

- Part I discusses a number of potential applications of ambient intelligence, and describes a set of scenarios. The part starts by addressing social, economic and ethical implications. It discusses electronics integrated into textiles, in smart rooms and intelligent buildings that could make our environment more friendly and enjoyable, more user-friendly, more effective, and in addition more energy efficient.
- Part II gives an overview of the networking and infrastructure issues involved in the realization and the implementation of an ambient intelligence environment. A networked infomechanical system, an operating system, a service-based application interface and a locationing and timing service are discussed for peer-to-peer ad-hoc wireless sensor networks. Furthermore, the security issue is discussed. This part concludes by presenting an alternative architecture, namely a network with a star topology, for improved power consumption and efficient data communication.
- Part III describes the basic components and technologies needed for the low-cost, low-power, small-size implementation of these ad-hoc ubiquitous networks of communication and computation nodes. Issues such as programming environment, energy supply, privacy and security, packaging and algorithms for various applications are addressed as well.

This book should appeal to wide range of audiences including the technologists, the system developers, the application programmers, and the potential users. As such, it can be used as a reference document for practicing engineers, but also as a text book for graduate courses that explore the avant-garde of the information technology age.

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