Chapter 1.11
Ambient Intelligence in Perspective

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INTRODUCTION

Ambient intelligence (AmI) is a relatively new and distinct interpretation of the mobile computing paradigm. However, its recognition that embedded intelligence, either in actuality or perception, is an essential prerequisite if mobile computing is to realize its potential distinguishes it from other mobile usage paradigms. Though stressing the need for intelligence, and implicitly the adoption of artificial intelligence (AI) techniques, AmI does not formally ratify any particular approach and is thus technique agnostic. In this article, we examine the constituent technologies of AmI and provide a brief overview of some exemplary AmI projects. In particular, the question of intelligence is considered and some strategies for incorporating intelligence into AmI applications and services are proposed. It is the authors hope that a mature understanding of the issues involved will aid software professionals in the design and implementation of AmI applications.

BACKGROUND

In 2001, the EU Information Society Technologies Advisory Group (ISTAG) launched a report that proceeded to define the term Ambient Intelligence (ISTAG, 2001). Over a decade earlier, the late Mark Weiser had defined his vision for ubiquitous computing (Weiser, 1991). This vision was far ahead of its time but has been perceived by computer scientists as a vision worth pursuing. As the various technological hurdles were being progressively overcome, ISTAG recognised the inevitability of ubiquitous, pervasive technologies being widely deployed. In practice, this would mean entire generations growing, learning, working and relaxing in an environment saturated with smart sensors and other embedded artifacts. However, a key problem was identified: how to facilitate intuitive interaction with the prevailing embedded technologies. In particular, the scale of these interactions could potentially give rise to situations where numerous artifacts would be clamouring for the individual's attention. Given that human attention is a scarce and precious resource, this course of action could have undesired consequences, and a situation could be envisaged arising where a user might perceive environments saturated with embedded technologies as being places best avoided. Hence, the objective of AmI is to facilitate seamless intuitive interaction between users and their environment.

CONSTITUENT TECHNOLOGIES FOR AMBIENT INTELLIGENCE

Ambient intelligence (AmI) (Aarts & Marzano, 2003; Vasilakos & Pedrycz, 2006) has evolved conceptually and practically, resulting in a common agreement on its core constituent technologies. Three technologies have been identified as being essential to AmI: ubiquitous computing, ubiquitous communications and intelligent user interfaces.

Ubiquitous Computing

Ubiquitous computing envisages the embedding of computational artifacts in the physical environment and their subsequent intuitive access by users. Concerned with the prominence of the then current range of computing systems and their unwieldy interaction modalities, Weiser hoped that ubiquitous computing would herald in an era of what he termed *calm technology*. However, before this could take place, significant advances would have to take place in a number of computing disciplines. One area of particular interest is that of smart environments, as such environments seek to deliver a practical realisation of the ubiquitous computing vision in everyday scenarios, including the home and office. Integration of microprocessors into people's everyday living space objects, such as furniture, clothing, toys and so on, allows the immediate living space to become sensitive and responsive to its inhabitants, rather than just remaining inanimate. Hence, the origin of the term ubiquitous, which implies that something exists or is everywhere within a living environment on a constant level. A concept closely associated with ubiquitous computing is that of context (Dourish, 2004). In ubiquitous computing, and indeed, other computer usage paradigms, it is envisaged that a model of the user and their environment is available, thus enabling the delivery of services to users that have been dynamically adapted according to the user's current context. Here, context may entail such factors as temporal information, elements of their individual profile (sex, languages spoken, etc.) and current location. In the latter case, absolute positioning, for example, geographic coordinates, or relative positioning, for example, west of a certain landmark, could be used, depending on the nature of the service in question. From a software perspective, the continuous process of capturing context and interpreting it is computationally expensive, and significant scope exists for incorporating intelligent techniques. Such techniques may be