Chapter 1.12
Ambient Intelligence Environments

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INTRODUCTION

The trend in the direction of hardware cost reduction and miniaturization allows including computing devices in several objects and environments (embedded systems). Ambient Intelligence (AmI) deals with a new world where computing devices are spread everywhere (ubiquity), allowing the human being to interact in physical world environments in an intelligent and unobtrusive way. These environments should be aware of the needs of people, customizing requirements and forecasting behaviours.

AmI environments may be so diverse, such as homes, offices, meeting rooms, schools, hospitals, control centers, transports, touristic attractions, stores, sport installations, and music devices.

Ambient Intelligence involves many different disciplines, like automation (sensors, control, and actuators), human-machine interaction and computer graphics, communication, ubiquitous computing, embedded systems, and, obviously, Artificial Intelligence. In the aims of Artificial Intelligence, research envisages to include more intelligence in the AmI environments, allowing a better support to the human being and the access to the essential knowledge to make better decisions when interacting with these environments.

BACKGROUND

Ambient Intelligence (AmI) is a concept developed by the European Commission's IST Advisory Group ISTAG (ISTAG, 2001)(ISTAG, 2002). ISTAG believes that it is necessary to take a holistic view of Ambient Intelligence, considering not just the technology, but the whole of the innovation supply-chain from science to end-user, and also the various features of the academic, industrial and administrative environment that facilitate or hinder realisation of the AmI vision (ISTAG,

2003). Due to the great amount of technologies involved in the Ambient Intelligence concept we may find several works that appeared even before the ISTAG vision pointing in the direction of Ambient Intelligence trends.

In what concerns Artificial Intelligence (AI), Ambient Intelligence is a new meaningful step in the evolution of AI (Ramos, 2007). AI has closely walked side-by-side with the evolution of Computer Science and Engineering. The building of the first artificial neural models and hardware, with the Walter Pitts and Warren McCullock work (Pitts & McCullock, 1943) and Marvin Minsky and Dean Edmonds SNARC system correspond to the first step. Computer-based Intelligent Systems, like the MYCIN Expert System (Shortliffe, 1976) or network-based Intelligent Systems, like AUTHORIZER's ASSISTANT (Rothi, 1990) used by American Express for authorizing transactions consulting several Data Bases are the kind of systems of the second step of AI. From the 80's Intelligent Agents and Multi-Agent Systems have established the third step, leading more recently to Ontologies and Semantic Web. From hardware to the computer, from the computer to the local network, from the local network to the Internet, and from the Internet to the Web, Artificial Intelligence was on the state of the art of computing, most of times a little bit ahead of the technology limits.

Now the centre is no more in the hardware, or in the computer, or even in the network. Intelligence must be provided to our daily-used environments. We are aware of the push in the direction of Intelligent Homes, Intelligent Vehicles, Intelligent Transportation Systems, Intelligent Manufacturing Systems, even Intelligent Cities. This is the reason why Ambient Intelligence concept is so important nowadays (Ramos, 2007).

Ambient Intelligence is not possible without Artificial Intelligence. On the other hand, AI researchers must be aware of the need to integrate their techniques with other scientific communities' techniques (e.g. Automation, Computer Graphics, Communications). Ambient Intelligence is a tremendous challenge, needing the better effort of different scientific communities.

There is a miscellaneous of concepts and technologies related with Ambient Intelligence. Ubiquitous Computing, Pervasive Computing, Embedded Systems, and Context Awareness are the most common. However these concepts are different from Ambient Intelligence.

The concept of Ubiquitous Computing (UbiComp) was introduced by Mark Weiser during his tenure as Chief Technologist of the Palo Alto Research Center (PARC) (Weiser, 1991). Ubiquitous Computing means that we have access to computing devices anywhere in an integrated and coherent way. Ubiquitous Computing was mainly driven by Communications and Computing devices scientific communities but now is involving other research areas. Ambient Intelligence differs from Ubiquitous Computing because sometimes the environment where Ambient Intelligence is considered is simply local. Another difference is that Ambient Intelligence makes more emphasis on intelligence than Ubiquitous Computing. However, ubiquity is a real need today and Ambient Intelligence systems are considering this feature.

A concept that sometimes is seen as a synonymous of Ubiquitous Computing is Pervasive Computing. According to Teresa Dillon, Ubiquitous Computing is best considered as the underlying framework, the embedded systems, networks and displays which are invisible and everywhere, allowing us to 'plug-and-play' devices and tools, On the other hand, Pervasive Computing, is related with all the physical parts of our lives; mobile phone, hand-held computer or smart jacket (Dillon, 2006).

Embedded Systems mean that electronic and computing devices are embedded in current objects or goods. Today goods like cars are equipped with microprocessors; the same is true for wash-