Chapter 12

Intelligent Decision-Making for a Smart Home Environment with Multiple Occupants

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Ambient Intelligence (AmI) systems rely on the use of environmental information to seamlessly assist users in their daily lives. As the development of AmI architectures is involving a larger amount of users and devices information, the potential occurrence of conflicts derived from the use of this information becomes higher. These conflicts are usually represented as inconsistencies between different pieces of information. As a result, the AmI systems need a mechanism to decide upon these conflicting situations in order to still give an appropriate response. In this chapter we propose the use of Argumentation as a methodology for automatically detecting and solving these conflicting situations. More specifically, we describe a smart TV service which combines different information about viewers’ presence and preferences and TV programs data to elaborate a list of recommending programs. Several arguments for and against recommending a same program are presented to the AmI system. Then, by means of argumentative techniques and several meta-decision criteria, the system is able to assist through mediation in the context of conflicting preferences or needs.

12.1 Introduction

Technological advances allow now the realization of a dream which decades ago was confined to the science fiction genre. A revolution is taking place in Computer Science driven by the availability of affordable sensing and actuating devices that can help a computing system to diagnose specific situations of interest and act consequently, all autonomously and unobtrusively [1]. These computing systems are grouped generically under the term
Intelligent Environments because at the core of each of these artificial systems a software module is providing both an intelligent analysis of the information gathered through the sensors and intelligent-decision making that will drive the actuation of the system upon the environment. The intelligent component is often termed Ambient Intelligence (AmI) [2, 3, 4, 5, 6, 7, 8] and the physical infrastructure (that also has some degree of intelligence embedded) is often referred as Smart Environment [9]. Intelligent Environments understood in the sense described above can be succinctly defined as: a digital environment that proactively, but sensibly, supports people in their daily lives [10]. This new paradigm can be exercised in many ways and examples of systems being explored at the moment by the scientific community and some leading companies are: Smart Homes, Smart Cars, Smart Offices, Smart Classrooms to name those that so far have attracted more attention.

Let us consider Smart Homes [11] as this is one of the areas more intensively explored and the one (together with Smart Cars) that is succeeding to reach a significant number of people. The development of this area has been so far largely dominated by a progression of pre-existing communities that were developing technology for telecare/telehealth. Researchers in those areas were mainly focused on building isolated systems that will help people to measure vital signs or to provide some level of speedy response to a problem. For example, people will have a device connected to Internet such that they can take their blood pressure and transmit that to a doctor’s computer who will monitor the progress of that parameter. Pendants with an emergency call button where offered as a necklace or a pull down cord will be placed in the bathroom allowing people who felt unwell or unsafe to transmit an alarm via a phone line to a response center which will call by phone and/or send a qualified person to visit the location where the alarm was issued. Researchers in this area progressively came into contact with different types of sensors that opened up the range of problems they were taking care of. For example a bed occupancy sensor allows to estimate how often a person was getting up from bed during the night and a combination of these occupancy sensors coupled with PIR (Passive InfraRed) and RFID (Radio Frequency IDentification) sensors allowed to gather substantial information of the whereabouts and habits of people in a house. Governmental organizations at political and health-care level realized of the potential to restructure health-care provision and decentralize the service shifting the care from the hospital to the home.

There is a substantial body of literature reporting interesting progress in this area [12]. Most of these solutions however are still at a seminal level and relies on important infrastructure constraints. One such common hypothesis is that there is only one person in the house or at