

Planning Agent for Geriatric Residences

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INTRODUCTION

Agents and Multi-Agent Systems (MAS) have become increasingly relevant for developing distributed and dynamic intelligent environments. The ability of software agents to act somewhat autonomously links them with living animals and humans, so they seem appropriate for discussion under nature-inspired computing (Marrow, 2000). This paper presents AGALZ (Autonomous aGent for monitoring ALZheimer patients), and explains how this deliberative planning agent has been designed and implemented. A case study is then presented, with AGALZ working with complementary agents into a prototype environment-aware multi-agent system (ALZ-MAS: ALZheimer Multi-Agent System) (Bajo, Tapia, De Luis, Rodríguez & Corchado, 2007). The elderly health care problem is studied, and the possibilities of Radio Frequency Identification (RFID) (Sokymat, 2006) as a technology for constructing an intelligent environment and ascertaining patient location to generate plans and maximize safety are examined.

This paper focuses in the development of nature-inspired deliberative agents using a Case-Based Reasoning (CBR) (Aamodt & Plaza, 1994) architecture, as a way to implement sensitive and adaptive systems to improve assistance and health care support for elderly and people with disabilities, in particular with Alzheimer. Agents in this context must be able to respond to events, take the initiative according to their goals, communicate with other agents, interact with users, and make use of past experiences to find the best plans to achieve goals, so we propose the development of an autonomous deliberative agent that

incorporates a Case-Based Planning (CBP) mechanism, derivative from Case-Based Reasoning (CBR) (Bajo, Corchado & Castillo, 2006), specially designed for planning construction. CBP-BDI facilitates learning and adaptation, and therefore a greater degree of autonomy than that found in pure BDI (Believe, Desire, Intention) architecture (Bratman, 1987). BDI agents can be implemented by using different tools, such as Jadex (Pokahr, Braubach & Lamersdorf, 2003), dealing with the concepts of beliefs, goals and plans, as java objects that can be created and handled within the agent at execution time.

BACKGROUND

During the last three decades the number of Europeans over 60 years old has risen by about 50%. Today they represent more than 25% of the population and it is estimated that in 20 years this percentage will rise to one third of the population, meaning 100 millions of citizens (Camarinha-Matos & Afsarmanesh, 2002). This situation is not exclusive to Europe, since studies in other parts of the world show similar tendencies (Camarinha-Matos & Afsarmanesh, 2002). The importance of developing new and more reliable ways to provide care and support to the elderly is underlined by this trend (Camarinha-Matos & Afsarmanesh, 2002), and the creation of secure, unobtrusive and adaptable environments for monitoring and optimizing health care will become vital. Some authors (Nealon & Moreno, 2003) consider that tomorrow's health care institutions will be equipped with intelligent systems capable of

interacting with humans. Multi-agent systems and architectures based on intelligent devices have recently been explored as supervision systems for medical care for the elderly or Alzheimer patients, aimed to support them in all aspects of daily life, predicting potential hazardous situations and delivering physical and cognitive support.

RFID technology is a wireless technology used to identify and receive information on the move. An RFID system contains basically four components: tags, readers, antennas and software (Sokymat, 2006). The configuration used in the system presented in this paper consists of 125KHZ transponders mounted on bracelets worn on the patient's wrist or ankle, several readers installed over protected zones, with up to 2 meters capture range, and a central computer where all the ID numbers sent by the readers is processed.

MAIN FOCUS OF THE CHAPTER

This article presents an autonomous planner agent for health care. The autonomous nature-inspired health care agent, named AGALZ, is presented. Then, a case study is presented, describing the main characteristics of ALZ-MAS architecture and its agents, including AGALZ, finalizing with initial results obtained after the implementation of a prototype into a real scenario.

Autonomous Nature-Inspired Health Care Agent

We have developed AGALZ, an autonomous deliberative Case-Based Planner (CBP-BDI) agent that integrates with other agents into a multi-agent system, named ALZ-MAS, as a proposal to improve the efficiency of health care and supervision of patients in geriatric residences. AGALZ presents a deliberative architecture, based on the BDI (Belief, Desire, Intention) model (Bratman, 1987). In this model, the internal structure and capabilities of the agents are based on human mental aptitudes, using beliefs, desires, and intentions. Our method facilitates the incorporation of CBR systems (Aamodt & Plaza, 1994) as a deliberative mechanism within BDI agents, facilitating learning and adaptation and providing a greater degree of autonomy than pure BDI architecture. A deliberative CBP-BDI agent is specialized in generating plans and incorporates a Case-Based Planning (CBP) mechanism. The

purpose of a CBR agents is to solve new problems by adapting solutions that have been used to solve similar problems in the past (Aamodt & Plaza, 1994), and the CBP agents are a variation of the CBR agents, based on the plans generated from each case. A CBP planner is used for AGALZ to find plans to give daily nursing care in a geriatric residence (Tapia, Bajo, Corchado, Rodríguez & Manzano, 2007). It is very important maintaining a map with the location of the different elements that take part in the system at the moment of planning or replanning, so using RFID technology facilitates enormously the dynamic planning.

CBR is a type of human thinking based on reasoning about past experiences. To introduce a CBR motor into a BDI agent it is necessary to represent the cases used in a CBR system by means of beliefs, desires and intentions, and implement a CBR cycle. A case is a past experience composed of three elements: an initial state or problem description that is represented as a belief; a final state that is represented as a set of goals and a solution (belief); and the sequence of actions that makes it possible to evolve from an initial state to a final state. This sequence of actions is represented as intentions or plans. Figure 1 shows the internal structure of a CPB-BDI agent.

In a planner agent, the reasoning motor generates plans using past experiences and planning strategies, so the concept of Case-Based Planning is obtained (Corchado & Laza, 2003; Glez-Bedia & Corchado, 2002). CBP consists of four sequential stages: retrieve stage to recover the most similar past experiences to the current one; reuse stage to combine the retrieved solutions in order to obtain a new optimal solution; revise stage to evaluate the obtained solution; and retain stage to learn from the new experience.

The CBP cycle is implemented through goals and plans. When the goal corresponding to one of the stages is triggered, different plans (algorithms) can be executed concurrently to achieve the goal. Each plan can trigger new sub-goals and, consequently, cause the execution of new plans. Deliberative CBP-BDI agents, like AGALZ, are able to incorporate other reasoning mechanisms that can coexist with the CBP. AGALZ is an autonomous agent that can survive in dynamic environments. However, is possible to incorporate communication mechanisms that allow it to be easily integrated into a multi-agent system and work coordinately with other agents to solve problems in a distributed way.

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