Chapter 4

e-Assistance Support by Intelligent Agents over MANETs

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Abstract

Through this chapter we introduce an e-Assistance Support system that combines recent technologies like Case Based Reasoning, Peer-to-Peer networks and Ambient Intelligence. Case Based Reasoning is a knowledge paradigm able to use previous experiences to solve new problem situations. Peer-to-Peer networks represents a well-known and proven asset to share resources among the members of a community. Last, Ambient Intelligence is an up-and-coming technological paradigm able to assist people and make their life easier using unobtrusive technologies. We have mixed these technologies in order to build a seamless e-Assistance system. With this system, people have at its disposal a mobile ad-hoc network able to solve specific problems through spontaneous connections among different nodes. We propose a system to solve daily problems taking advantage of the power of a CBR multi-agent system (MAS) that exchanges its cases through a P2P mobile ad-hoc network. Finally, we tested the proposed system in what we call an intelligent gym for physical training.

4.1 Introduction

Ambient Intelligence is an amalgam of technologies able to sense and actuate over a concrete environment willing achieve some well-known goals. Obviously, these goals are provided by a human being, who is the main member of that environment and the direct beneficiary of the system. In order to achieve these goals, the environment needs to be populated with digitally equipped devices able to carry out computational and communication processes.

Every person facing a situation where he does not know how to act can use ubiquitous computing and ambient intelligence in order to achieve e-assistance. To carry out this assistance, collaboration among agents within a multi-agent system for complex troubleshooting can be used.

We present here an architecture to assist users facing novel or unknown specific situations. This
architecture consists in a set of intelligent agents that are able to communicate with each other through an ad-hoc mobile network. We start from the idea that current problems or situations are, at least, similar to the problems or situations that other users had experienced in the past. This means that we can use the previously acquired experiences. In order to achieve those experiences we establish a peer-to-peer network among the agents of the system. Through this network we can exchange the previously acquired experiences, or cases.

Some studies have been done related with using centralized Case Based Reasoning intelligent agents as well as studies about resource sharing through peer-to-peer networks. We propose a system that combines both approaches, modeling the Case Based Reasoning agents as mobile peers and using a peer-to-peer network to exchange experiences, i.e., problems and their solutions, among them.

4.1.1 Multi agent systems (MAS)

Agent Theory (AT) and Multi Agents Systems (MAS) has become an active researching area of Artificial Intelligence in the last years. A lot of definitions, and consequently its defining characteristics, has been proposed for the concept of agent. We are going to back the well known definition given by Wooldridge and Jennings [Wooldridge and Jennings (1995)] where agents are entities that represents humans with the following characteristics (see Fig. 4.1):

- Autonomy. Agents have to operate without external human control over their actions and decisions.
- Reactivity. Agents have to sense the changes of the environment and adapt its behavior to these changes.
- Proactivity. Agents must have the ability to focus its actions and decisions to achieve its own goals.
- Sociability. Agents must have the ability to communicate with humans and other agents through a predefined protocol.

There exist some other abilities that help to define what an agent is and how it should behave:

- Benevolence. Agents must not hide information nor its intentions, or refuse to help when it is able to do it.
- Rationality. Agents must base its decisions on the acquired knowledge and modify its behavior depending on the experience.
- Veracity. Agents can not provide wrong or inaccurate information on purpose.
- Mobility. Agents should be able to achieve its objectives being executed in a computing network.

There are tasks or problems that can not be solved for an unique agent due to its lack of knowledge or ability to face a given situation. In this situation, a multi agent system can be useful to face the task. A MAS is a system where agents collaborate to solve complex domain problems [Wooldridge (2002)]. In order to solve these problems they cooperate exchanging information. Usually, the original task can be divided in several sub-tasks and the different agents of the MAS can solve individually one or more of these tasks. This way a MAS can be used to solve more complex problems.

There is not an unique architecture to develop agents given that exist different types of agents for different tasks. For example, some agents can be designed to make fast decisions and some others can value more the accuracy of the decision. The architecture depends of the goal, the tasks to be carried