

Heterogeneous Domain Ontology for Location Based Information System in a Multi-agent Framework*

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Abstract. The growing interest in mobile devices in new different scenarios increases the need to create context-aware multi-agent systems. Interaction between users is produced in many environments and new mobility technologies allow access information anytime and anywhere. Many researches and location systems have focused in specific domains to share knowledge between agents. This article proposes a global ontology to let agents work with heterogeneous domains using a wireless network. The intention of the proposed ontology is to provide customization about different environment services based on user location and profile.

Keywords: ontology, heterogeneous domain, multi-agent system, wireless network.

1 Introduction

Nowadays, mobile devices have a series of powerful computation capacities, which opens us towards new environments where the users interact between them and access to the information anywhere and anytime [9]. User mobility, new wireless technologies and the need to receive context-dependent information, promote new user location systems that adapt and customize information according to user position, rather than classic systems which do not support automatic detection of user location. [10]. Mobility allows users to access information anytime and anywhere, so due to user position, these location based systems provide context-aware information in the environment where the user is located. In the same way scenarios change, the system has to adapt itself to new domain information. This article proposes a high level conceptualization ontology allowing systems to adapt to heterogeneous domains in commercial area.

Museum domain is one of most used domains, and several applications based on user location have been implemented, addressed mainly for Semantic Web. One of them is KORE [8] that uses agents to obtain visitor position in the museum, and to customize information according to the visitor profile. In KORE, information

* Funded by projects CICYT TSI2005-07344, CICYT TEC2005-07 186 and CAM MADRINET S-0505/TIC/0255.

exchanged between agents is defined by an ontology, which only covers a specific domain. Other research projects propose the introduction of a mediator agent, which contains user location knowledge, defined by a location ontology, and determines the best service for the user [11] [12]. The main point of ontologies is the connection between physical information in real world and conceptual information in digital world. Several researches have later identified three basic features for this kind of systems: previous knowledge of agents, cooperation between context and devices, and independence of application [6].

The intention in this contribution is to apply user location and information personalization to large and dynamic domains, using a more versatile ontology to allow very different information exchanges between agents. The proposal here is to design and implement such ontology that should cover a wide application domain. The ontology aim is to be shared and re-used by agents. Ontology universe allows using agents in several business area contexts (conferences, department stores, fairgrounds etc.) agents obtain user position and profile user information, and according to these, they provide personalized and recommended information about the context. The proposed multi-agent system runs on a wireless network, where visitor information, as well as supplier information, will be managed by visitor/supplier agents while one special agent handles all position information.

The chosen internal architecture of agents is based on the BDI model (Belief-Desire-Intention) [3], who is one of the most used deliberative paradigms to model and implement internal reasoning of agents. The BDI model allows viewing an agent as a goal-directed entity that acts in a rational way [2]. The framework Jadex has been selected as development platform to support the use of the reasoning capacities by BDI model deployment with software engineering technologies as XML and Java [1].

For accomplishing objectives, agents need to communicate between them. Since there are a large variety of communication environments, we focus in ontology development to allow sharing knowledge in a global domain which may cover several contexts [7]. Communicative acts between agents are expressed through FIPA-ACL messages (Foundation for Intelligent Physical Agent ACL), which allows selecting content language and ontology inside messages. We adopt as content language RDF (Resource Description Framework) and RDFS (RDF Schema) [6] for information description. As ontology development tool Protégé-2000 is selected, because it allows performing in different platforms and interacting with standard storage formats as XML and RDF [5].

This article describes a generic ontology for a multi-agent system to be applied to in any context of commercial or business nature. Section 2 presents different research related to the objective of this contribution. Section 3 explains the problem of using a single ontology for different contexts, and its motivation. It describes the proposed ontology, including abstract concepts and relations between them, which constitute the communication language domain between agents. Section 4 illustrates the problem with some example cases. Finally, Section 5 reports some conclusions.

2 Previous Works

At present, mobile devices establish new scenarios where users can interact in many environments and access to information anywhere and anytime [9]. Numerous