Model of interaction among embedded agents in ubiquitous computing environments

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***Abstract*—This research is motivated by the need to propose a model for studying the interaction of people in educational spaces such as museums, assisted by ubiquitous computing environments. People are represented as mobile software agent which have certain characteristics, limited knowledge and the necessity to interact with others to achieve individual or collective goals in a specific context. We propose a model of interaction context-dependent among embedded agents in ubiquitous computing environments that facilitate interaction between people and the museum, taking into account its ontology, autonomy, pro-activity, mobility and social skills.**

***Index Terms*—Interaction, Agents, Ubiquitous Computing, Context.**

I. Introduction

The evolution of computational science to date is characterized by five trends: ubiquity, interconnection, intelligence, human-oriented and delegation [1]. The significance of two of these trends intelligence and delegation involves building computer systems that are able to act in place of the people, i.e. the possibility of first act independently and secondly, the ability to represent their interests in the best possible way when interacting with other people or systems. The different ways that the user can interact with educative spaces (i.e.museum) make a need how the applications can adapt (even automatically) to the situations, improving interaction. The computation presence in ubiquitous way gives to the users the expectation that it is possible to access information and services anywhere. Besides that, the mobility provided by the ubiquity makes the user context, like the location, people and objects around become more dynamic to interact.

The great variety of situations in which the user can be involved makes necessary a way to the applications adapt (eventually in an automatic way) themselves according to the situations, providing a better support to the human computer interaction [2], [3]. A way to improve the support to the human-computer interaction is to improve the communication during the interaction, making the computer able to process the contextual information of the user, the machine and the system communication, allowing the implementation of more useful computational systems (context-awareness)[4]. Context-aware applications use environmental context inputs to provide information to the user or to enable customizable information based on their preference.

A. MAS Adoption in ubiquitous computing environments

We adapting Multi-Agent Systems (MAS) to aid the ubiquitous computing environments in order to get a dynamic adaptation for the user's context. We need to create interfaces that can adapt itself according to the user context. Depending on parameters like: identity, location, action, time, services,etc. We need provide the most suitable services to be more adaptable and focused on user's behaviour. [5], [6]. The MAS approach complements the modular and flexible infrastructure, providing a high level of adaptation to user activity. We argue the MAS paradigm is appropriated to model and implement ubiquitous computing environments, especially when we consider the agents collaboration, mobility, autonomy properties and supported by novel technologies to helps reasoning and learning techniques, knowledge bases to deal with traversal issues such as adaptability.

II. Methodology

We will use the meaning of sending the computer to a "background", refers to two different but related concepts, the first one is the literal meaning, that computer technology should be integrated into objects, things, tasks and daily environments. And the second one is that integration must be done, so that the introduction of computers into these things or objects do not interfere with the activities for which they are interact and always provide a more convenient, simple and useful objects with properties such as communication, memory, context-sensitive and reactive. It is argued that the incorporation of autonomous capabilities can significantly increase its power, especially in highly dynamic environments and multiple agents [7].

We help us further applying a simplified Agent-Oriented Software Engineering (AOSE), methodology consists of developing two main models: specifying the individual interacting entity roles and the their properties such as their interaction

protocols and knowledge-sharing model (organisational view model); specifying the nature of the internal computation for each organisational entity or role, e.g., determine the plans to achieve a goal or reasoning to check the validity of a new fact. AOSE design is captured in two main model views: an organisational view which specifies the types of agents and roles, and an operational view which specifies the interaction constrained by goals and plans of actions to achieve those goals. Modelling active entities in the system as agents versus roles is often a matter of preference or style. However, (organisational) roles support a more dynamic approach [8].

Agents may suggest alternative courses of action and negotiate conflicts. They can help to achieve common goals more effectively in such highly dynamic environments, such as geographical separation, coordination of groups that have limited bandwidth of communication, changing events and the physical environment. The state that coordination is an efficient cooperation and interaction among agents, taking into account the communication and computational resources of the system [9]. We need use search techniques where agents need to find the most appropriate agent to carry out general and specific objectives in order to minimize the expected cost of search, resulting in better interaction. Local information is accumulated in the historical interactions between agents.

In order to cope with complex tasks, agents are usually organized in a network, where an agent interacts only with its immediate neighbours in the network. Self-organization is defined as ”the mechanism or process that allows the system to change its organization without explicit external command during runtime” [10], this can be used in networks of agents to improve behaviour, interaction and cooperation. We need to define the coverage area of sensors for general and specific areas, used to provide the service for users to interact. Being almost imperceptible when using one or another.The wireless sensors could be located throughout ubiquitous computing environment to detect users.

We can to create an user-friendly environment, efficient and distributed support services, we need improve their environment and support for human interaction, which the users are surrounded and helped for a digital context-aware environment based on a model of interaction. We need to define the different devices for user's interaction like sensors, can be used on user's body and clothes (sensor vest) to allow the identification for the use, get data and administration of services.

III. Case Study

As a case study carried out the observing and modelling scenes on public spaces that may represent a real example, because they have a variety of interactive exhibitions and shows various situations that can rise due to the presence of groups of people. In the first instance due to the extent of its facilities and the dynamic that presents product of the daily activities, the installations of the Trompo Museum, located in Tijuana, Mexico is a magnificent place for the case study because is an interactive educative museum dedicated to children and teenagers, and its primary goal is to be a place where they can interact and play while they are learning. Nowadays we are in the process of collecting and analysing information in order to model adaptive systems to ensure high quality of interactive service.

IV. Conclusion

We need get a model of interaction among agents that can facilitate and simplify communication, interaction between them, allowing faster response times, increasing the organization creating a community among agents more organized, structured, independent and able to react to events all the time. Create scenarios of ubiquitous computing environments, validating the model with different scenarios and case studies proposed experiments in virtual environments such as simulations and tests.

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