A Human-Like SOA-Based Interdisciplinary Framework for Intelligent Virtual Agents

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Abstract. The creation of virtual humans capable of behaving and interacting realistically with each other requires the integration of interdisciplinary theories, methods and approaches. Although Intelligent Virtual Simulation has focused on realistic interactions of their inhabitants, it still reflects the necessity of a common framework capable of integrating all the technological advances developed separately. This paper combines some of the successful approaches carried out with the purpose of defining an openness framework that help making the development of Intelligent Virtual Agent based systems as easy as possible by the integration of these independent and different domains. The paper also presents a case study based on a virtual assistant helping a human and learning from him to use UML (Unified Modelling Language) for modelling different systems.

Keywords: IVA, SOA, OAA, BDI, XML, FIPA, architecture, learning.

1 Motivation

Virtual environments tend to be more important every day, especially in education programs, e.g. [3, 19] and entertainment, e.g. [12]. Many of the applications that have been developed until now in this field require some type of virtual agent that can observe, decide and react in its virtual environment becoming then Intelligent Virtual Agents (IVA). On the other hand, this kind of applications will be better accepted as long as IVA’s are closer to be virtual humans who are directly related to the design of believable social agents.

Moreover, social behaviors make intensive use of many human abilities, such as vision, hearing, memory, subtle body control, human animation, etc. Furthermore, it is also necessary to consider intelligent agent common activities, such as planning, reasoning, learning, communicating, etc. Therefore, designing believable social intelligent agents is a challenging task, since most of the abilities to reproduce are very complex and require a multi-disciplinary approach.

Fortunately there are several researches in the areas of IVA’s, intelligent agents and agents in general, that can be used to satisfy these required multi-disciplinary approaches. However, these researches are independent so an integration of these
domains altogether is necessary in order to design a successful believable social intelligent agent or virtual human, this representing a highly motivating and technical challenge. A good illustration of this goal is described in [8, 10, 11, 16, 20]. This paper focuses also on the design of a common framework for agents with the following characteristics: 1) it has to be extensible to IVA´s, 2) it merges interdisciplinary theories, methods and approaches, 3) it must be extensible and open as to be completed with new requirements and needed, and 4) it has to highlight the agent´s learning process within the environment. This proposal, called SIFIVA (SOA-Based Interdisciplinary Framework for IVA´s), is the actual result of the research work whose first results can be consulted in [14, 15]. What makes SIFIVA different to other similar frameworks is the way in which its main features have been integrated to behave in an appropriated way.

The paper is organized in different sections: section 2 describes the proposal; section 3 describes some implementation details and an example related to a virtual assistant for modelling different systems using UML and section 4 includes the conclusions and areas for future work.

2 SIFIVA’s Framework

This section describes the proposed framework for IVA´s (SIFIVA), starting with the design of the architecture and then goes on to describe some of the components associated to this design. It should be pointed out that this work is actually in progress and therefore this proposed will continue evolving.

SIFIVA is the result of a sum of various ideas that putting all together conform an open and extensible framework for IVA´s. One on these ideas is related to OAA (Open Agent Architecture) [9] in which the authors defined a framework for the construction of distributed software systems based on the cooperation among agents. In OAA the agents can be easily incorporated into, or unincorporated from, the system. Another contribution of this work is the use of a “facilitator”, originally defined by Genesereth et al in [7], which maintains a knowledge base that records the capabilities of a collection of agents in order to assists requesters and providers of services in making contact.

Therefore, from the OAA design SIFIVA takes the following ideas: 1) to dynamically add/remove capabilities to the IVA; 2) to have a register of these abilities, and 3) the necessity of having a component that facilitates the integration. There is a basic difference: these abilities are not considered like agents as occurs in OAA but they are services in SIFIVA.

In this sense, the work of FIPA (Foundation for Intelligent Physical Agents) is prominent in this subject to structure an agent as a set of services, specifically the AWSI-WG (Agents and Web Services Interoperability Working Group) whose main purpose is to fill the interaction gap between agents and web.

In the FIPA specifications, the agent system interoperability is based on the use of a common Agent Communication Language (ACL) [5] and supported by an Abstract Architecture [6] which can be used to abstract the internal architecture of each agent. From FIPA, the way in which the services can be registered and discovered as well as