Plan Delivery and Visualisation in Collaborative Planning Environments

Planning, user interfaces, multiagent systems

Abstract

In collaborative planning environments, visualisation and delivery of planning information can be developed aiming to increase the level of integration between participating agents (software or human) of virtual organisations. This work considers the requirements of collaborative environments to propose a visualisation framework to support better agents' interactions and activities performing. The framework operates in the following way: (1) from a giving scenario (defined by agent, device, resource, and planning information) (2) maps to a specific class of visualisation, (3) where 'Classes of Visualisation' are based on modalities of presentation. The intelligent mapping mechanism considers the semantic of the information available, and it is capable of reasoning based on real standards [W3C, 2003a] [W3C, 2003b].

1 Introduction

One important aspect of realistic intelligent planning systems is that they have to allow collaboration between users and computer systems, supporting a mixed-initiative style of planning. The synergy of both human and software agents produce better results, so it should be encouraged.

Studies in mixed-initiative planning have been applying the concept of Virtual Organisations [Foster *et al.*, 2001] to join both human and computer strengths to solve problems. Examples of large scales virtual organisations are 'Humanitarian Relief Operations' or 'Military Coalitions', which in many critical and unpredictable situations have to be rapidly created and flexibly changed.

In order to accomplish better synergies between human and software agents in collaborative planning environments, virtual organisations need to improve the level of integration between participant agents and also provide better understanding of the whole process by individual and global perspectives. These issues can be addressed by planning visualisation and delivery approaches.

In this context, the main goal of this work is to propose new advances in planning visualisation and delivery that fit the requirements of a collaborative planning environment.

The ideas of this research are anchored in the I-X [Tate, 2003] approach. The I-X project provides a set of technologies for intelligent systems that supports the principles of collaborative planning environments. I-X is based on shared models for task-directed communication between human and computer agents who are jointly collaborating on the synthesis of an artefact such as a plan or a design.

In order to permit the integration of agents on the move, we are taking the advantages of J2ME [SUN, 2003], the Java SUN platform aimed to mobile computing. J2ME increases opportunities for artificial intelligence development in mobile devices, since it is the first open and platform independent (operating system and hardware) API for pervasive computing [Huang *et al.*, 1999]. In this way, portable devices can be a tool for planning delivery and visualisation to mobile agents in critical situations, where small personal planning aids can help.

2 Visualisation Framework

Several aspects are considered for the formalisation of this visualisation framework approach:

- Planning information to be shown, such as plan descriptions, planning execution, plan simulation, standard procedures, etc.;
- Agents' characteristics and requirements, for example, roles, capabilities, authorities, relationships, requested or needed information;
- Device capabilities, for instance, potentialities, device type, screen size, memory capacity, processing power, connectivity, especial features;
- Extra resources, such as maps, sketches, and GPS that can be used to support information presentation.

Taking into account all these aspects, this work proposes a generic, abstract and flexible framework for planning delivery and visualisation. Two main parts compound that framework (Figure 1): a visualisation categorisation and an intelligent mapping.

The definition of 'Categories of Visualisation' is based on modalities of presentation and resources for visualising and delivering of information. The categories will provide a better abstraction and understanding of the visualisation problem.

The intelligent mapping mechanism maps from a scenario characterisation to a specific 'Visualisation Category'. The scenario characterisation is defined by the planning information to be shown, the agent characteristics, the device capabilities and the resources available.

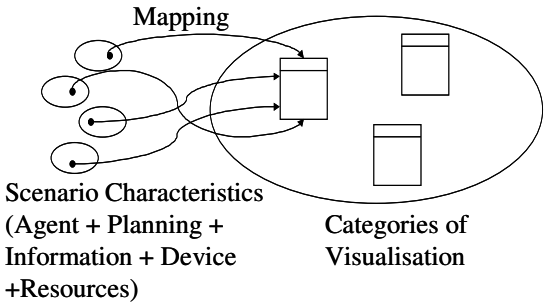

Figure 1 – Visualisation Framework Abstraction

Categories (or modalities) of visualisation can be previously defined, although, the system should be flexible enough to permit definition and creation of new categories/modalities that can be needed from user's demand or new technological advances. The modalities previously defined are: Descriptive, Tabular, Graphic, Multimedia, Voice, Natural Language, and Virtual Reality.

A specific scenario determines one category of visualisation, through an intelligent mapping. The mapping reasoning works in the following way:

- XML and related technologies are used as knowledge representation tools, to represent Categories of Visualisation and information that define a scenario;
- Based on these information the system is able to reason about itself, and adequate the scenario to the more appropriate way of visualisation.

We understand that the evolution that the Web is going through, and the way that information is being represented cannot be ignored [W3C, 2003c], mainly if we intend to build systems that will access data all over the web and/or allow collaboration based on shared information.

The technologies upon which the Semantic Web has been built, for instance, XML (Extensible Markup Language) [W3C, 2003a], RDF (Resource Description Framework) [W3C, 2003b], VoiceXML [W3C, 2003d] and more advanced ones, such as DAML (DARPA Agent Markup Language) [DARPA, 2003], allow data to be described with its associated semantic. Thus, data is becoming more understandable and reasoning processes can be carried out on it. These aspects broads perspectives for developing intelligent systems.

3 Conclusions and Future Work

This presented approach contributes to improving the task of collaborative planning information visualisation in many ways. First, it is being deployed as a generic framework, including several modalities of presentation and not exploring only one specific way. Second, it is being designed to be flexible, and extensible, so, if a new situation requires a different way of presenting information, one new category can be created or changed. Third, the implementation in mobile computing platform is not based in any specific current technology or a specific handheld device. Instead, what is being considered is which types of features are suitable to each case of visualisation. Finally, this approach will permit the improvement of the levels of integration among the participating agents (human and software) via a visualisation approach with meaning and reasoning based on real standards.

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