

Animated BDP Agents in Virtual Environments

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Abstract

We introduce a Believes, Desires and Plans (BDP) agent that acts in a virtual environment using multi-modal interaction with the user. The environment is our virtual theatre environment. In this environment different agents have been introduced. In order to obtain a more uniform framework for agent interaction and a more uniform agent architecture we introduced a BDP agent for interactions between visitors and domain agents that inhabit this environment. We demonstrate how such an agent can play the role of a librarian in a virtual library.

1. Introduction

In our virtual theatre environment [6] we experiment with virtual reality, agent technology, multi-modal interaction and, in particular, we pay attention to (virtual) humans interacting with a visualized environment and the role this visualization plays. Several agents have been introduced. The approach has been bottom-up. We started with an information and transaction agent (Karin) that could be accessed, using NL, about performances in a theatre. Karin is a 3D embodied agent that shows simple facial expressions and - using lip synchronization and TTS synthesis - mouths her answers.

We experimented with several agents that help the visitor to navigate in this virtual environment and to find the information that suits his interests. Our present agent (cf. [5]) can be addressed natural language. It knows about the environment, the locations and objects and the routes that can be walked to go from one location to another. The visitor walks around in the virtual environment, but he can also look at a 2D map and see where exactly he is. Positioning the mouse on objects allows the visitor to ask a question like "What is this?", or say "Bring me there.". In the latter case the navigation agent gives control to an agent that guides the user to the desired position. A framework that allows the introduction of different agents is described in [2].

2. Dialogues with BDP Agents

As mentioned, our approach in introducing agents in our virtual environment has been bottom-up. Only after having some agents that had to interact with each other and with the visitor we came up with a framework that allowed communication between agents and the introduction of new agents. The next step in our research is the introduction of a

more uniform agent architecture which should allow us to introduce agents with different knowledge, intelligence and behaviour. Behaviour in our environment includes verbal and nonverbal communication with the visitor, animation of face and body parts (since some of our agents are embodied) and performing ‘physical’ actions in the virtual environment. For that purpose we introduced our version of BDP (Beliefs, Desires, Plans) agents, agents that can be used for multi-modal interaction in virtual environments. Beliefs and desires are represented with quasi-logical forms [1]. Conditional plans (CPs) allow actions according to some conditions. For specifying a BDP agent an agent specification language has been developed. A BDP interpreter applies conditional plans given a current state of the agent. BDP agents can interact by sending and receiving messages using a communication platform [2]. In order to construct dialogue systems using our BDP agent technology we extended the QLF formalism with communicative acts. Agents are plan-based, but they can communicate with other agents in order to perform actions or make dialogue moves.

3. A Library Agent in a Virtual Library

For demonstration purposes we have applied the BDI agent framework in a virtual library world. The world contains books and boxes. The agent knows CPs for placing books in boxes and removing them from boxes. The librarian receives QLF input from the visitor through a parser, linguistic analyser and a reference resolver and it selects plans and goals according to this input. Changes in the virtual environment are accomplished by sending messages to (and receiving them from) virtual environment agents that can make changes to the environment. The system allows multimodal input. For instance, the visitor may position the mouse-pointer on a book and ask “Who is the author of this book?”, requiring the library agent to apply unification on information that comes from different sources. Currently we are working on an embodiment of this library agent so that we can really see an agent retrieving and storing books. Java has been chosen as the implementation language for the system.

References

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