

# Programmability of Intelligent Agent Avatars

## (Extended Abstract)

Zhisheng Huang <sup>a</sup>

Anton Eliëns <sup>a</sup>

Cees Visser <sup>a</sup>

<sup>a</sup> Vrije University of Amsterdam, De Boelelaan 1081, Amsterdam

In this paper, we propose an approach to the programmability of intelligent agent avatars, supported by the Distributed Logic Programming language DLP. The intelligent agent avatars can be considered as one of the applications of web agents. As one of the testbeds of the 3D web agents, we are developing and implementing soccer playing avatars. In this paper, we discuss how DLP can be used to support soccer playing avatars using rules to guide their behaviors in networked virtual environments.

Distributed logic programming [2] combines logic programming, object oriented programming and parallelism. We selected DLP as the tool for the implementation of intelligent web agents, because of the following reasons:

- **Functionality.** DLP accepts the syntax and the semantics of the standard logic programming languages. Thus, it is a formal language for artificial intelligence.
- **Distribution.** DLP is a distributed programming language. Thus, DLP programs can be executed from several computers which locate distributively. Moreover, DLP allows multiple threads of the programs, which makes it as a convenient tool for the implementation of multiple agents. Furthermore, DLP programs are compiled as java classes, which makes it as a powerful tool for the implementation of mobile web agents.
- **Availability.** DLP has been extended with a 3D VRML Client Interface Library, which includes all the primitives of the sensor/effectors mentioned above, but also their VRML EAI (external authoring interface) counterparts [4], including the operators for getting and setting all of the field values. For the details of the DLP extensions, please refers to [1].

We have selected the soccer game as one of the benchmark examples to test the implementation of 3D web agents and explore the scenarios in which several avatars are playings the soccer game in VRML 3D virtual worlds. Those avatars can be supported either by ordinary users, like human beings, or by intelligent agents, which are controlled by DLP programs. Moreover, we also use DLP programs to control the whole scenario of the game and the formulation of the physics and dynamics of the soccer games, for instance, the behaviors of the soccer balls and the scoring of the games.

A demonstration version of WASP soccer game is now available for free download from the WASP web site [5]. The program runs on Netscape web browser in which Blaxxun VRML browser has been installed.

Soccer player avatars are controlled either by a software agent, i.e., DLP programs, or by a human user. Based on their controlling modes, soccer player avatars are classified into two types: soccer player and soccer player user. Soccer players are ones which is controlled by a software agent, whereas soccer player users are ones controlled by human users.

Each non-human player has the following cognitive loop: sensing-thinking-acting. By sensing, avatars use their sensor to get the necessary information about the current situation. After sensing, the perceived information becomes the parts of the agent's beliefs. In the stage of the thinking, avatars have to reason about other players' positions and roles, and decide how to react, based on their preferences, which come from the desire component, and the information about the current situation, which comes from the belief component. Thinking would result in a set of intentions, more exactly, a set of intended actions. By acting, avatars would use their effectors to take the intended actions.

In the current version of WASP soccer games, we do not require that agents would know all the laws of soccer games. The agents in the WASP soccer game use a simple cognitive model of soccer game, in which the agents considers the information about several critical distances, then make a decision to kick. Based on such a simplified cognitive model of soccer games, each player even shows significantly intelligent behaviour.

DLP has been extended with the primitives of sensors/effectors for 3D web agents. Powered by DLP, those primitives of sensor/effectors can be extended into more sophisticated and powerful of sensors/effectors. The intelligent behaviors of the game playing avatars heavily depend on the situation knowledge of the avatars. The most useful information for deciding the playing strategies is to reason about the positions of other players and the position of the soccer ball. Although WASP soccer games are still under development, our tests have proved that the technologies of intelligent web agents and DLP are convenient and powerful tools for the implementation of intelligent agent avatars.

## References

- [1] DLP web site: [www.cs.vu.nl/~eliens/projects/logic/index.html](http://www.cs.vu.nl/~eliens/projects/logic/index.html).
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- [4] ISO, *VRML97: The Virtual Reality Modeling Language, Part 2: External authoring interface*, ISO/IEC 14772-2, 1997.
- [5] WASP project home page: [wasp.cs.vu.nl/wasp](http://wasp.cs.vu.nl/wasp).