Virtual 3D: A Multi-Agent System for Visualizing RoboCup Simulation League Games with Intelligent Camera Control

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Abstract. Virtual 3D is a system that enables both real-time and off-line visualization of 2D RoboCup simulation games in a 3D environment. The system itself is a Multi-Agent System in which each camera is modeled as an intelligent autonomous agent. Given their perceptions, camera agents are able to decide the best viewing perspective at each moment and send high-level information to a Director agent that is responsible for the final decision concerning the image or images to show to the spectators.

1 Introduction

The RoboCup soccer server is an ideal platform for the study of Multi-Agent Systems. Traditionally it is used as a tool to study multi-agent coordination and communication based on the development of agents that control players. Our approach is also concerned with the study of multi-agent systems using the soccer server and RoboCup simulation league as a test bench. However, our main contribution is the development of a 3D visualizer associated with a multi-agent camera control system that enables real-time and off-line visualization of soccer-simulated games. The server itself keeps track of the game state in a 2D coordinate system, including the positions, and velocities of all objects and sends it to the visualizer. With the developments of graphics technology associated with the research on virtual 3D worlds, it is now possible to develop applications to show realistic 3D visualization of these soccer games. Several research labs have already proved this concept with systems like Virtual RoboCup or The Venue 3D. However, our system diverges from previous approaches both because of its realistic animations and sounds as well as its multi-agent intelligent camera control approach.

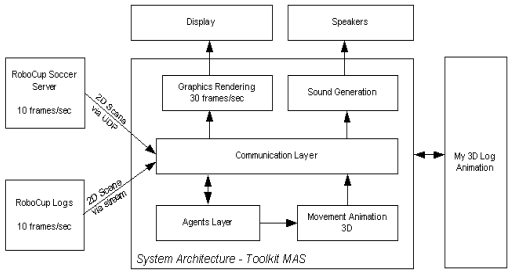

Figure 1: System Architecture

2 System Architecture and Features

Virtual 3D system features include a 3D environment including a stadium; Intelligent camera control in a multi agent structure; Slow motion replays; Generation of 3D sounds based on the emotional structure of spectators; 3D models (Studio Max) for the players with real animation; DirectX7+ support; 3D positional sound engine and Soccer Server compatibility for logfiles and live games. We plan to extend the system with an intelligent commentator and the calculation of game statistics.

Virtual 3D was developed based on a Multi-Agent System architecture. Five layers support this architecture (figure 1): graphics rendering (using RenderWare), sound generation (for public, referee and players), communication, 3D animation and the Agent System. Camera agents try to focus the game in the best possible perspective and calculate several measures for the visualization quality. These measures are then used by the director agent to decide the best image to show.

Figure 2: Virtual 3D

3 Results and Discussion

The impact of our first prototype (figure 2) on its users was very motivating. Spectators confirmed that visualizing RoboCup simulation league games with Virtual 3D gives them the feeling of watching real soccer games on Television. We believe that these first motivating results of our 3D virtual environment are concerned mainly with the combination of a realistic environment including a stadium, appropriate player animations and sound effects with intelligent human-like multi-agent camera control.