A Framework for Immersive VR and Full-Body Avatar Interaction

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Abstract

We present a new software framework for the development of distributed immersive collaborative virtual reality applications with emphasis on full-body interaction with virtual humans. The framework is implemented in C++ and has a main entry point in a derivable core class. Depending on the functionality required, different modules, instantiated as managers, can be requested. The core is highly flexible and application’s instances can also be customized from a unified configuration file.

System Architecture

The framework provides an internal cluster communication engine with bandwidth efficient synchronization and a general purpose communication channels (master–slave interactions with a sliding window) for the cluster rendering/state synchronization and a multi modal motion planner. Customized engines can be added.

Device Manager and the 3D GUI

This manager handles interaction devices. Virtual devices are created on request and virtualized to a higher level format. A client-server extension handles platform-dependent devices. The 3D GUI manager includes primitives for distributed interactive widgets.

Full-Body Interfaces Enabled by the Framework

Our framework has been successfully employed on a number of research projects for more than three years [1][2].

Motion Modeling

User demonstrates to a virtual human how to perform motions. During the training phase the virtual human reproduces the motions in interactive training sessions with apprentice users learning the training subject [1]. The system includes new algorithmic solutions for motion parameterization [3].

Physical Therapy

Allows therapists to create new upper-body exercises by direct demonstration, and then the autonomous virtual therapist provides automatic interactive exercise delivery and monitoring to users. The application also supports networked collaboration.

Interactive Motion Visualization

Provides full-scale visualization for inspection of synthesized full-body motions. Inspected motions have been synthesized from a motion graph algorithm with obstacles, and then integrated with a multi modal motion planner.

References


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