A Collaborative Virtual Environment for Industrial Training

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Abstract

The concept of Collaborative Virtual Environments has been deployed in many systems in the past few years. Applications of such technology have been used anywhere from military combat simulations to various civilian commercial applications. In this paper we present a specific system developed for industrial teletraining. The system, which aims to reduce the cost of training, consists of an interactive 3D environment with collaboration and management capabilities that allow a trainer to lead and control a session attended by many trainees.

1. Introduction

We have designed and implemented an industrial teletraining prototype. At the request of our sponsors, the prototype has been created for training of operation of ATM switching equipment; however it can easily be modified for any type of training, and the performance results can be generalized for industrial teletraining.

2. Prototype

Our prototype is a multiuser teletraining application which allows users, represented by avatars, to learn how to operate on a faulty ATM switch. The avatars repair the switch in steps which precisely reflect those necessary to perform the same actions in the real world. The prototype consists of two general modules: user interface, and network communications. The user interface itself consists of graphical interface (GUI), 3D interface (VR), and audio interface (speech recognition). Figure 1 shows the initial interface of the system. One can control the prototype by using a point-and-click approach, selecting actions in menus or by voice recognition of commands. The voice recognition is speaker independent and has been implemented based in Microsoft ® SAPI.

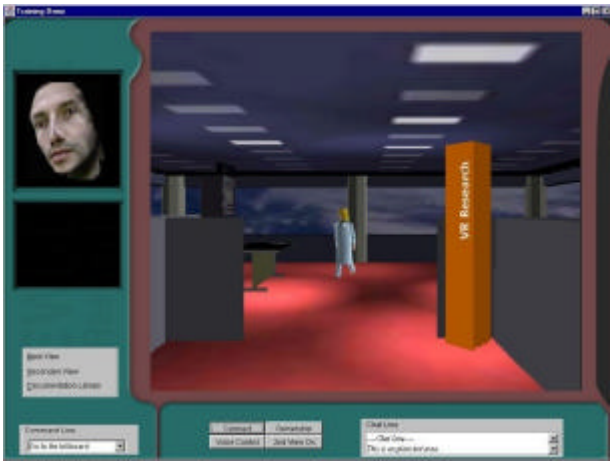

Figure 1. Training Application's Interface

3. Architecture

The system is composed of the following sub-layers: Communication (C++), Control (Java), Speech Recognition (C++/MS SAPI), Audio Capturing and Playback (C++), Visual Rendering (Java3D), H.263 Video Decoder (Java) and Head Tracking (C++). The head-tracking layer captures a user's video and fetches his/her head rotations/translations based on Video Processing and Motion Estimation. All modules are stand alone and communicate via sockets governed by the control layer. Native code communicates with Java via Java Native Interface.

There are IPv4 and IPv6 versions of the communication layer. A user may choose which one is desired upon startup of the prototype by selecting the appropriated DLL and server.

The architecture has been show to scale well and presents very low delays.

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