AGJuggler

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1 Introduction

Even though there are several theories on how new knowledge is generated through collaboration [Lipponen et al. 2004], it is generally agreed that interaction among groups or teams can be beneficial in the accomplishment of many tasks. With the globalization phenomenon and current advances in network computing, geographically distributed teams are very common in the present and technologies are developed in order to facilitate collaborative work among scientists and professionals. On the other hand, authors also agree that having the ability to immerse in a computer-generated world, and visualize and manipulate 3D data proves to be useful in many settings. Leston [1996] illustrates the benefits of virtual reality (VR) by quoting the Chinese proverb *"I hear, I forget / I see, I remember / I experience, I understand"* (p. 12). In order to facilitate a richer interaction among geographically distributed teams, the toolkit we have developed, AGJuggler, brings the features of virtual reality into existing collaborative technologies.

Collaboration technologies have been developed since at least the 1980s; videoconferencing was one of the first applications that became popular because it facilitates meetings without the need to travel and it also offers a great level of flexibility [Kauff and Schreer 2002]. However, collaboration is not only about distributed meetings but also sharing data, sharing resources and enabling interaction; so collaboration frameworks or environments offer several features like video/audio conferencing, shared data repositories and applications that can be executed by remote users at the same time. Some examples of such collaboration environments are Microsoft® ConferenceXP [Microsoft Corporation 2004], its predecessor NetMeeting [Microsoft Corporation 2005] and the Access Grid™ [Futures Lab n.d.].

The motivation for developing our toolkit was the belief that VR can improve interaction among participants in a collaborative environment and help overcome issues related to the sense of presence and availability of customizable solutions. There has been interest and development of multi-user VR technologies since the 1980s and 1990s [Stevens et al. 2003], however the range of applications is limited and they are often intended for a specific purpose. Most of the available applications rely on dedicated communication lines and/or don't have other collaborative, conference-like features. The objective of our work was to take advantage of the functionality offered in collaboration environments and the features of VR, and integrate them into a toolkit called AGJuggler, a customizable solution for offering a richer collaborative experience to geographically distributed teams.

2 Proposed scenario

A shared application in the Access Grid™ (AG) is a piece of software that can be executed by two or more people simultaneously [Futures Lab n.d.]. The software is installed locally on each client's computer; there is no need to make modifications to the venue server. During the shared application session, participants can view, modify, and add information. The Shared Presentation is an example of the applications included with the AG software; it is used to open and see a PowerPoint presentation in a synchronized way. Additionally, the AG Toolkit (AGTk) offers routines to create custom shared applications. These routines provide programmers with the ability to access information regarding participants connected to a session, upload/download data to the venue server and to communicate among clients via events.

Figure 1 shows the proposed idea of a collaborative session. The objective is to have participants sharing the same virtual world through their connection to the AG/AGJuggler server; each one with their own VR configuration –from desktops running in simulator mode to immersive environments using tracking hardware and any other device; with the ability to navigate the world with their own point of view and see each other as avatars. Each VR application will appear as a different shared application available for the users to install and run, so for example they can select from a virtual tour, an interactive exploration of a 3D model, etc.

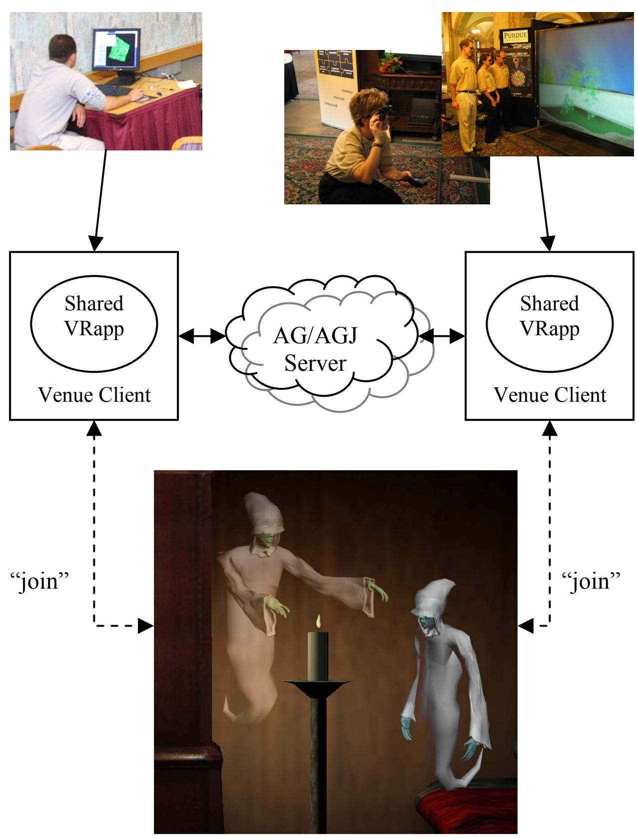

Figure 1: Proposed virtual reality session in the Access Grid™

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3 AGJuggler implementation

The toolkit implements a class AGJuggler that can be instantiated by any application in order to connect to a server and start a session. An AGJuggler session consists of several clients running a VR application that uses the toolkit to share data with other participants. Each client maintains information about participants, their status and device data; they can also define application specific data that can be shared through the server.

One of the issues with creating distributed applications is the efficient use of network resources. Previous attempts at sharing visualization through the Access Grid™ have required high bandwidth and exhibited low frame rate because they transmit whole video frames among clients. AGJuggler addresses this by only sending the data necessary to update the state of the virtual world and participants. Each client stores a local copy of the 3D models and uses the data to render the current frame locally; this approach also allows local control of the view –sites generate their own frames and so can have different points of view.

4 Conclusion

The vision of this study was to bring the benefits of virtual reality to collaboration environments, and integrate both technologies in order to offer a richer and truly collaborative experience in which participants are more than just spectators. Some examples include: architects at distant geographical locations designing a building together, meeting in the Access Grid™ to discuss the project and having a real-time, interactive exploration of their model; scientists visualizing data, sharing their observations from each one's point of view and making annotations; artists having a distributed performance with actors on many locations and the audience immersed in the world with them.

AGJuggler is a toolkit that consists of a set of libraries that provide routines and functions that can be added to existing VR applications in geographically distant AG nodes and have them implement a collaborative session. Node hardware setups may vary for each site. Some may have fully immersive CAVE™ –like setups [Cruz-Neira et al. 1993] with tracking, while others may have only a PC equipped with active stereographics ability, or even a laptop with no stereo capability. This provides collaborators the ability to share virtual worlds, where participants are able to change their own point of view and see others represented as avatars.

Future work includes making group experiences richer by further integration of VR and collaboration technologies. Some characteristics that such virtual environments could offer are whiteboard functionality inside the 3D world and the possibility of running other collaborative applications from the virtual world. Additional functionality to be developed to extend the set of operations that can be performed in the virtual world and avatar animations.

5 References

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