Midterm Report: IPRO 351

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Virtual Reality: Developing an Advanced Immersive Visualization Environment at IIT

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Members

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Updated Objectives

The objective for the Spring 2005 IPRO 351 team remains unchanged from the project plan. The team still intends to develop a business plan for the installation of a virtual reality facility on the IIT Main Campus, with implementation divided into three primary objectives. First the team will research current virtual reality institutions and applications.

Second the team will investigate how a VR installation can be funded based on an analysis of the initial space and cost requirements. The team will further investigate potential sources of funding and develop a budget for a system that could be assembled by a student team and developed into a virtual reality facility on campus.

Finally the team will develop plans and specifications for such a system, including a long range plan for how to integrate virtual reality into teaching at IIT. Stages of the plan will possibly include visualization of models and data already available, dynamic models of scientific processes, system-to-person interactive models, and person-to-person constructive models.

Results to Date

The Product Group

The product group has made significant progress in answering the questions it originally set out to answer. In addition the group made a trip to the UIC electronic visualization laboratory (EVL) where the team experienced firsthand several VR systems, including the CAVE, Geowall and ImmersaDesk.

What is virtual reality and what are the current systems out there?

Virtual reality refers to computer simulations that use 3D graphics in conjunction with interactive devices that together provide the illusion of immersion in the simulation, or virtual environment. The most common systems today can be divided into three classes:

The CAVE Systems (http://www.evl.uic.edu/pape/CAVE/)
The CAVE is a multi-user virtual environment invented at the electronic visualization laboratory at UIC in 1991. Graphics are projected in stereo onto three walls and the floor and viewed with active stereo glasses. The room-sized system also provides audio immersion. Interaction is provided via a handheld wand and a location sensor attached to the stereo glasses. Variations on the CAVE include the Bright Advanced Technology CAVE.

The Geowall and Variants (http://geowall.geo.lsa.umich.edu/index.html)
The Geowall is a self-built, projector-based virtual reality system. It consists of two stacked projectors and stereoscopic glasses. Images and movies projected onto the screen are viewed in 3D with glasses. Like the CAVE, the Geowall is a multi-user system. Unlike the CAVE, it is smaller and much more portable. In addition, the basic self-built Geowall does not include any interactive device. Commercial versions of the Geowall are also available, such as the Power Wall.

The ImmersaDesk (http://www.evl.uic.edu/research/res_project.php3?indi=163)
The ImmersaDesk is a drafting table format VR display developed in 1994 at EVL. It allows up to 5 users to see in 3D with shutter glasses. One field of view is tracked by a location sensor, providing an accurate perspective to the viewer. A tracked wand, usually a force-feedback haptic device, is also used to allow the user to interact with the environment. Stereo sound is included. The ImmersaDesk is portable and sits on wheels that allow it to be deployed in various spaces. Simpler variations on the ImmersaDesk include stereoscopic screens that do not include any interactive device and several that do not require stereoscopic glasses to view the screen in 3D.

What applications can virtual reality find on the IIT main campus and what can virtual reality contribute to IIT?

Applications on campus include 3D visualization of buildings in architecture and of molecules in biophysics. These applications would apply to both classroom lectures and also academic research and design. In addition, several psychology-based applications have been noted including alternative learning scenarios. The computer science department could also use a virtual reality system to expose its students to the field and to give them firsthand experience with modern technology. The team has also considered the possibility of bringing in high school students to teach them about virtual reality. In addition a virtual reality system may also serve to provide entertainment to the students on campus. Other potential applications include 3D visualization of the designs used in engineering. Research into the other areas in which virtual reality could prove useful continues.

How much will it cost to install a virtual reality facility on campus?

The team found a general range for the costs of each virtual reality systems. These costs are included below:

System	Cost ($)	Maintenance
CAVE	250,000-400,000	Special Projectors Sent to Canada for Repair $25,000 / Year
Power Wall	80,000-120,000	Unknown
VR Desks	60,000-125,000	Unknown
GeoWall*	10,000	Regular costs to replace Projector Bulbs

*Unlike the other systems, the GeoWall would not be installed by a commercial company and would require assembly by students or the school.

What universities already own virtual reality facilities?

The team limited its initial research of universities with VR facilities to the Chicago area. The team found that many colleges already own institutions, including:

University of Chicago
University of Illinois at Chicago
Northwestern
UIUC

The team concluded that the Illinois Institute of Technology is one of the few technical universities to not own any virtual reality facility.

Although significant progress has been made on the product side, several important questions remain to be answered:

-Who would use virtual reality on campus?
-How long will it take to implement a virtual reality system at IIT?

However, based on the data found, the product group has currently decided to focus its efforts on the possibility of a Geowall on campus. It was decided that the costs for installation and maintenance of the CAVE rendered it unfeasible at the current time. Furthermore, the ImmersaDesk system was too limited in that only a small group could access it at any given time. Of course, the team will continue to examine both of these options, but the current consensus is that the Geowall would be the best route. A more detailed analysis of the properties and applications of the Geowall, including software compatibility will be the next step. The product group is also currently trying to bring in an outside vendor to present on the current state of VR.

The Resource Group

The resource group set out to determine what sources of funding were available to the school. At the start, the group joined the Community of Science page and examined several National Science Foundation grants. Unfortunately the vast majority of grants were only available to established virtual reality facilities. The group was unable to find any grants for start-up institutions. The team intends to continue its search and may examine what funds are available to each department. In addition, the team is currently pursuing the possibility of sponsorship by the Digital Media Center and will consider outside corporate sponsorship as well.

Revised Schedule

The schedule remains relatively unchanged. Work is divided roughly into three phases: research into virtual reality and sources of available funding, the review and evaluation of all data found, and the creation of a business plan and long-term plan. A tentative schedule with the deadlines set for the phases is listed below, along with the due date of several IPRO particulars.

Objective	Finish by/Date
Research Virtual Reality and Available Sources of Capital	Mar 25
Midterm Report Due	Mar 25
Review and Evaluate Research Found	Mar 30
UIC Trip: TechNews Article	Mar 31
EON Vendor Visit	Apr 6*
Draft Business Plan and Long-Term Plan	Apr 27
Presentation and IPRO Day	Apr 27

*Tentative Date.

Updated Assignments

The individual assignments remain relatively unchanged. The Midterm Report was delegated to Robert Chang. Currently the team has no plans to create a website and the task remains unassigned.

Team Leader, Project Facilitator	Robert Chang
IPRO Office Liaison	Gerald Norby
Budget	Gerald Norby
<u>Product Group</u>	
Group Leader	Johannes Smith
VR Research	Johannes Smith
Applications	Robert Chang
	Gerald Norby
Competition	Eliza Birek
<u>Resource Group</u>	
Group Leader	Madhur Merchant
Federal Grants	Ibrahim Habib
University Funds	Michael Abdul
Other Capital	Madhur Merchant
<u>Documentation</u>	
Log	All Members
Project Plan	Robert Chang
Midterm	Robert Chang
Business Plan	All Members
IPRO Website	Currently Unassigned
Oral/Poster	Robert Chang
	Johannes Smith

Barriers and Obstacles

Several barriers to the IPRO were encountered. At the start of the IPRO, the team had intended to visit the VR installation at the Aurora Sci-Tech Museum or at the Argonne National Laboratory. However both were closed for repairs. As a result, plans were made to visit the facility at the University of Illinois at Chicago. Another obstacle the team encountered was a lack of information from commercial vendors on their VR systems. Most do not list prices and the team had to send a request to find out more. On the resource side, the biggest barrier so far has been the lack of available start-up funds. The group is currently examining alternate sources of funding but it is uncertain whether it will find any. This obstacle will be ongoing until capital is secured for the project.