Immersive Displays: The Next Generation

Nature of Proposal: Innovative Student

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ABSTRACT
Current immersive display technology is cumbersome to use, unstable, and lacks full field of view coverage. We propose to develop and construct the next generation of immersive display technology for research and education, evaluate its effectiveness as a psychophysical tool, and create novel content for this new display surface. The proposed next generation display will be a hemispheric dome supported with air. This display will increase the system’s scalability, decrease its packaging size, weight, and assembly time, as well as overcome shortcomings in the current technology’s limited field of view coverage.

Dollar Request: $6,500

Desired Funding Dates: February – September 2009

BACKGROUND
Recently, through efforts associated with the Center for Imaging Science, the House of General Science, the College of Science, and the Imagine RIT Innovation and Creativity festival, the iPix Laboratory was established as a cross-disciplinary organization dedicated to liberating pixels from their normal confines of traditional display technologies in an effort to stimulate creativity and revolutionize the learning experience. From these efforts immersive display prototypes have been created for use in many applications such as, Color Science research, new Media presentations, science lessons, and planetary studies. These prototypes are currently being refined while other departments and outside industries are catching on to their unique ability to convey information.

State of the Art
Many factors constrain the current immersive display prototype. For example, the immersive environment has been limited due to budget restraints and the high cost of short throw Digital Light Projectors (DLPs). In addition, assembling the display panels is a timely process involving multiple people and various tools. Transportation of the entire display is also difficult due to the size of structural elements. Figure 1 shows a current immersive display prototype with three panels in an arch to encompass a portion of an observer’s field of view. Each panel must be constructed individually using four long pieces of conduit, which are screwed together. After each panel is created, they are connected to each other and the display material must be stretched and clamped in place. Problems arise at the seams between the panels where a wire must be used to eliminate bowing and create a flat surface. This prototype is not stable, and the display may bend or sag causing errors in calibration, which results in a timely recalibration process.
Figure 1. Current Immersive Display using 3 flat screens.

**SCIENTIFIC JUSTIFICATION**

A truly immersive environment will encompass an observer’s whole field. Current prototypes do not meet this criterion. Figure 2 depicts the next generation of immersive display technology that will. In this example, an air cavity inflates a hemispherical dome. Clear ports on the exterior allow for display on the inside canopy. A door is provided for easy access to the observer, who is free to traverse the inside without obstructing the display.

Figure 2. The Next Generation of Immersive Display Technology:

**Structural Advantages**

The next generation of immersive displays has many benefits other than the improvement in the field of view coverage. Because the dome is made from material it can be collapsed into a very small package making transportation light and easy. The dome assembly is as simple as plugging in the power and as fast as flipping a switch. Once inflated with air, the dome is a stable structure that will not sag or bend out of alignment.
Surround Effects

When studying the perceptual effects of colored surrounds it is essential to fully immerse the observer in the surround. In the natural world we have the ability to discount the illuminant so that a white card under candlelight and fluorescent light both appear white though their measured values are different. It is hypothesized that through evolution more natural surrounds, like blue from the sky, green from a tree canopy, or yellow from a sunset can be easily discounted while other more unnatural surrounds, like red, magenta, and purple cannot. Psychophysical studies will be conducted to determine the observer’s ability to discount surrounds of various color hues, and lightness values. This model will be very important in the future of display technologies as lighting manufactures switch to colored LED lighting solutions for home and retail settings and integrate them with Media content for advertising and cinema.

Visualization

The use of three-dimensional data has long been utilized to enhance the perceptibility of hard to see attributes that are otherwise impossible to access. Volumetric data generated through such means as Medical imaging, LIDAR, and computers are typically displayed in 2 dimensions. Using this new immersive display, scientists would be able to get inside the data and study it from all angles simultaneously as well as traverse through its volume in 3 dimensions.

New Media

Gaming, multimedia, presentations, and cinema can all benefit from this new technology. Presentations will no longer be limited to a rectangular screen. Movies will utilize the periphery, sneak up on observers, and create a whole new cinematic experience. This tool will give artists a new way to display themselves and their artistic vision. It will give the gaming community its most realistic virtual reality experience. It will also give a whole new life to applications such as the Sims, Google earth and street view.

Other Applications

As a teaching tool, the immersive display will engage students in the learning process. Teachers will be able to visually take their students anywhere in time or space with virtual field trips. Simulations for training in areas of combat, flight, and driving will greatly be improved.

BUDGET REQUEST – $6,500

Funds are requested to help build and test the new immersive display. Funds would include material costs ($3500), assembly costs ($2000), and an undergraduate assistant ($1000).

Material Cost Estimates

Air Blower Assembly: $500
Display Canvas: $3000
Display Canvas Assembly: $2000
Undergraduate Assistant: $1000

PROJECT PLAN

The project will be completed in 8 months.

*Preliminary Design* – 4 weeks. Draft of plan is completed.
*Research of Materials* – 4 weeks. The needed materials are evaluated and ordered. Work that cannot be completed in house will be outsourced.
*Design Implementation* – 8 weeks. This phase of the research will include assembly of the immersive display.
*Calibration* – 8 weeks. The system will be calibrated and characterized.
*Content Generation* – 4 weeks. Novel content will be created for use within the dome.
*Testing* – 4 weeks. The system will be evaluated and re-configured to create an optimal display.