Acquisition of an Immersive Virtual Reality CAVE® System for the South Jersey Technology Park
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Executive Summary
We propose to purchase a fully-immersive, multiply-interactive and navigable Fakespace CAVE® system for installation in the designated Virtual Reality (VR) lab in the South Jersey Technology Park’s Sam Jones Innovation Center (see Fig. 1).

Fig. 1: Proposed plan of the 1st floor of the Innovation Center (partial view), and location of the CAVE® system.

This acquisition expands and enhances Rowan University’s capabilities in research and development in VR technology as demonstrated with the previously grant-funded purchase of a Fakespace Immersadesk® – a semi-immersive prototyping system currently housed in the Imaging & Nondestructive Evaluation (NDE) lab in the College of Engineering.

The purchase cost of CAVE® system is $429,878 (please see attached quote).
Research Needs and Project Team

The primary research activity in the Imaging and NDE lab and its current inventory of equipment is illustrated in Fig. 2. We use multiple inspection methods (X-ray, ultrasound, magnetic, optical etc.) to interrogate test objects (pipelines, geomaterials, aircraft fuselage, etc.), neural networks to perform multi-sensor data fusion and VR displays for advanced scientific visualization. This lab provides a unique confluence of capabilities and has been successful in attracting funded exceeding $2.3 million (to date).

Purchase of a fully-immersive VR system, such as the CAVE® allows the principal investigators in this project to significantly advance the state-of-the-art in their respective research fields. Dr. Mandayam’s work in multi-sensor data fusion has demonstrated the potential of VR as an integration platform for large data sets consisting of graphical, measurement and model data, such as those that arise in the Space Shuttle Main Engine Test Stand (currently funded project). Dr. Sukumaran’s work in modeling angular geomaterial particle assemblies has shown that visualization of 3-D shapes plays a significant part in understanding geomaterial response – particularly important for understanding the stability of structures in earthquake-prone regions (currently funded). Dr. Rusu’s work in information visualization has provided methods for effectively combining disparate data to extract relevant information (funding search in progress). This proposal provides a vehicle for combining the research talents of these three faculty – Drs. Sukumaran and Mandayam have existing co-funded research projects. Drs. Rusu and Mandayam have established research collaboration by sharing graduate students.

The intellectual merit of this research activity lies in developing algorithms for visualizing massive information-rich data sets in a VR environment. The ability to effectively combine graphical, measurement and model data; allow an operator to rapidly sift through large data sets to isolate regions of interest; and to enable a user to ask “What if?” questions for developing virtual scenarios; all these are powerful tools in numerous R&D applications.

Impact

Previously funded research projects in the Imaging and NDE Lab have had significant educational impact. To date, the Lab has employed 38 undergraduate research assistants and 14 graduate research assistants. The Lab has supported an average of three multi-disciplinary Engineering Clinic projects every semester since Fall 1999, impacting approximately 150 students. So far, 9 Faculty from three engineering disciplines (ECE, ME, CEE) and Computer Science have collaborated on research and education projects. Industrial partners include NASA, US Navy, ExxonMobil, Thomson Consumer Electronics, Physical Acoustics Corporation, etc.

The Lab has also seen extensive media coverage – television (The History Channel, Channel 6-ABC), local newspapers (Courier-Post, Phila. Inquirer, Gloucester County Times, Star Ledger) and national magazines (ASEE Prism, Pipeline & Gas Journal, ASCE Civil Engineering Magazine etc.) and has been featured multiple times in the annual President’s Report.

It can be anticipated that the installation of a CAVE® in the South Jersey Technology Park will serve to similarly showcase the capabilities of Rowan University’s brand new facility.
The proposed acquisition has significant potential to foster collaborative research activities among other faculty in the University. The CAVE® is the most widely installed fully immersive VR system in the world and is used for research in protein synthesis, biotechnology, computational fluid dynamics, town planning, modeling marine ecosystems, etc. In addition, Rowan University’s connection to the Gigabit Ethernet (or Internet2) via its NJ-EDGE subscription allows CAVE®-to-CAVE® collaboration over remote distances with numerous federal agencies (DoE, NASA centers, NRL, etc.) and Universities who have installed CAVES®.

**Fig. 2:** Existing capabilities in the Imaging & NDE lab.

**Installation Issues**

The system footprint is 11.6’h x 30’w x 22’d. The lab modules in the Innovation Center are 12’h x 32’w x 24’d. We anticipate that the dividing wall between in the NDE lab and the VR lab will have to be removed – and are in consultations with the architect.
Additional Information

Research projects that are positively impacted by this purchase:
3. “Synthesis of 3-D Particle Assemblies for Modeling Shear Response in Geomaterials,” NSF, $250,000, (submission planned in the near future).