Cyber-Infrastructure (CI) TEAM Demonstration: Interactive and Collaborative Learning Environment Using Virtual Reality Games Promoting Meta-cognition for Science and Engineering Design in Context

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INVESTIGATORS

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SUMMARY

This project is an ambitious collaboration between Rowan University - a public institution, Tennessee State University (TSU) - a Historically Black College and University (HBCU), the Educational Information and Resource Center (EIRC) - a non-profit educational organization, and four local vocational/high schools with a large population of underserved students (Burlington County Institute of Technology, Camden County Technological School and Bridgeton High School in New Jersey, and Pearl Cohn Business Magnet School in Tennessee). The focus is to design and implement a virtual reality (VR) game system that infuses cyber-infrastructure (CI) learning experiences into the pre-engineering/technology-based and engineering classrooms to promote meta-cognition for science and engineering design in context. Using city infrastructure as the theme and engineers solving real-life problems as the scenes, the games of future sustainable city design engage students, particularly prospective and beginning science and engineering students, in CI-enhanced and -enabled science and engineering discovery. More importantly, the games incorporate the access to visualization, simulation, modeling and collaboration tools, creating an interactive and collaborating learning environment for students to digitally explore science and engineering concepts via virtual analysis, design and production. The CI capabilities of the game system make it possible for learning to occur not limited to a classroom but in any place and at any time, fostering life-long learning that is a key for learners to adapt to the continuously changing nature of society. In addition, the explicit meta-cognitive strategies and context-oriented approaches addressed in the game improve students’ learning and prepare them to be better designers, benefiting the society as a whole in the long run. With no additional software and hardware required, the game system can be installed and configured in any network server, and then run in any network-enabled personal computer, making our development cost effective and easily transportable. Considering the importance of teachers in raising student performance, the project will also design and run a 4-day CI professional development workshop to disseminate specific project information to the cadre of teachers. Additionally, an online Content Management System (CMS) will be provided by the EIRC for the workshop to deliver content and for teachers to reflect, share, and access information 24/7, ensuring a rapid, successful transition of our innovation to the benefit of broad students. Two graduate students will be involved with the design and development of CI modules throughout the lifetime of the project.
S. Keith Hargrove, Ph.D.
Dean, College of Engineering, Technology and Computer Science

In June, 2009, Dr. S. Keith Hargrove was appointed the Dean of the College of Engineering, Technology, and Computer Science at Tennessee State University (TSU). He previously served as Chairperson of the Department of Industrial, Manufacturing & Information Engineering in the Clarence Mitchell, Jr. School of Engineering at Morgan State University in Baltimore, MD. Dr. Hargrove received his B.S. degree in Mechanical Engineering from TSU in 1985, M.S. degree from the Missouri University of Science & Technology in Rolla, MO, as a National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc. (GEM) Fellow, and the Ph.D. degree from the University of Iowa as a Committee of Institutional Consortium (CIC) Fellow. Dr. Hargrove was a Boeing Welliver Faculty Fellow (2008), and a Harvard Fellow with the Division of Engineering & Applied Sciences, Harvard University (2005-2006). He served as Assistant to the Dean and Associate Professor of Mechanical Engineering at Tuskegee University, and has worked for General Electric, Battelle Pacific Northwest Laboratories, National Institute of Standards and Technology (NIST), Oak Ridge Laboratories, and General Motors. Dr. Hargrove has conducted research projects with Sikorsky Aircraft, Boeing, NASA, and the US Army in systems engineering, design, and manufacturing. He is an Associate Member of the Society of Manufacturing Engineers, Institute of Industrial Engineers, American Society for Engineering Education (ASEE), and the Tennessee Society of Professional Engineers.

Dr. Hargrove's current research interests are in virtual and augmented reality, advanced manufacturing systems, systems engineering and management, and minority engineering education. As Dean of the College of Engineering, Technology and Computer Science, he is promoting strategic initiatives that focus on ACCESS (recruitment), AFFORDABILITY (scholarships and research funding), and ATTRITION (innovative curriculum and retention).

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Dr. Sachin Shetty is currently an assistant professor in the Department of Electrical and Computer Engineering - College of Engineering, Technology, and Computer Science at Tennessee State University (TSU). He received his B.S. degree in Computer Engineering from the University of Mumbai, India in 1998, M.S. degree in Computer Science from University of Toledo in 2002, and Ph.D. degree in Modeling and Simulation from Old Dominion University in 2007. His area of competency includes theoretical and experimental research in protocols design, performance analysis, security algorithms, virtual and augmented reality, and system implementation of wireless networks, cognitive networks, ad-hoc networks, and sensor networks. He has received external research funding exceeding $1 million from the National Science Foundation, the U.S. Department of Energy, and the Tennessee Board of Regents for his research and educational innovations. He has authored and coauthored, including students, over 25 technical refereed and non-refereed papers in various conferences, international journal articles, book chapters in research and pedagogical techniques.