

# NATIONAL UNIVERSITY OF SINGAPORE

School of Computing

## C S S E M I N A R

**Title: Graphics-based Affordable Desktop Virtual Reality for Interactive and Active Learning in STEM Disciplines**

**Speaker:** Assistant Professor Magesh Chandramouli  
Computer Graphics Technology  
Purdue University Calumet

**Date/Time:** 18 July 2016, Monday, 04:00 PM to 05:00 PM

**Venue:** Executive Classroom, COM2-04-02

**Chaired by:** Dr Bhojan, Anand, Lecturer, School of Computing  
([bhojan@comp.nus.edu.sg](mailto:bhojan@comp.nus.edu.sg))

### Abstract:

This lecture discusses the applications of computer graphics(CG) based affordable desktop virtual reality (VR) tools in various areas of engineering and technology (ET) education. ET departments in many universities are facing challenges in areas such as increasing enrolment and retention, increasing student success rates, enhance critical thinking and problem solving skills of students, etc. Crucial among the various important factors that impact the above issues pertains to 'motivating STEM students' and 'stimulating them to learn'. Students who are well motivated seldom drop out of the courses and are willing to persist in the face of challenges, as they have a desire to learn despite obstacles. However, stimulating students' interest is a challenging issue and there is no single method to promote student engagement across various ET disciplines. Various ET disciplines such as mechanical, robotic, industrial, construction, civil, mechatronics, graphics, etc. have their inherent application domains characterized by problems of specific nature and design criteria which require specific problem knowledge. However, problem-solving and critical thinking (PS/CT) skills are important to any and all the above disciplines, which is why PBL (Project Based Learning) and AL (Active Learning) techniques are being promoted actively by many ET schools. Even though many schools have recognized this, the financial aspect associated with the additional infrastructure that may be required for enhancing the curriculum for incorporating interactive PBL and AL exercises to promote critical thinking can be a deterrent factor. Hence, this proposal explains various approaches involving the use of an interactive desktop Virtual (dVR) framework to methodically organize and present domain-specific activities to students. A strong understanding of the fundamental mathematical, geometric, trigonometric, and physics (or any other required) fundamental aspects plays a crucial role in determining the career-success of students. Students, especially those at the beginner's level, typically tend to associate theoretical knowledge with 'textual information' involving

substantial reading. Virtual Reality applications were built using web-friendly XML-based technologies such as VRML/X3D and Java/JavaScript to facilitate online dissemination. This is presented using a low-cost portable VR system so that the overall system remains cost-effective. This way, technology and engineering schools that would like to implement such a system for teaching fundamental Engineering & Technology (ET) theory to students will not be deterred by the high costs of immersive facilities (e.g. CAVE-Computer Assisted Virtual Environments).

This kind of affordable desktop VR framework was designed and implemented for the following:

1. Interactive VR framework for Additive Manufacturing Instruction
2. A fun-learning approach to programming using an adaptive Virtual Reality (VR) platform
3. Desktop VR Centered PBL in ET Courses
4. Virtual Assembly of Underwater Remotely Operate Vehicle (ROV)

Biodata:

Dr. Magesh Chandramouli is an Assistant Professor of Computer Graphics Technology at Purdue University Calumet. He completed his doctoral studies at Purdue University, West Lafayette where he was awarded the prestigious Frederick Andrews Fellowship. Dr. Chandramouli completed Master of Engineering from the National University of Singapore and Master of Science from the University of Calgary. He has presented his work and delivered invited lectures in India, USA, Canada, Europe, Singapore, and Hong Kong. He has authored 2 books and published his work in prestigious international journals.