COMPUTER SCIENCE 5754
Virtual Environments

(ADP TITLE: Virtual Environments)

I. Catalog Description

Introduction to the theory and practice of three-dimensional virtual environments (VEs). 3D input and output devices, applications of VEs, 3D user interfaces and human-computer interaction, 3D graphics techniques for VEs, 3D modeling and level of detail, evaluation of VEs, VE software systems and standards, collaborative and distributed VEs. Includes hands-on experience with VE hardware and software.

(3H, 3C).

II. LEARNING OBJECTIVES

Having successfully completed this course, the student will be able to:

- distinguish virtual environments from other types of computer graphics and user interfaces
- demonstrate an understanding of the principles involved in constructing effective 3D user interfaces
- identify the various types of devices used for virtual environments and explain the advantages and disadvantages of each
- evaluate user performance and usability in virtual environment applications
- use and evaluate various VE toolkits and 3D modeling programs

III. JUSTIFICATION

Course Content

Virtual environments (VEs) are a rapidly-growing, multi-disciplinary field with applications in a wide variety of domains. The inclusion of this course within the computer science program of study allows students to gain knowledge of an advanced topic related to many lower-level courses, such as computer graphics and human-computer interaction. The course provides basic background information about VEs, but also exposes students to state-of-the-art research and current hardware and software for VEs. The course will prepare students for research in this area or related areas. Virginia Tech has a large group of faculty and students working in the area who can provide practical, hands-on experience and research projects.

Course Designation/Level

This course is proposed for the 5000 level. This course will offer graduate credit. It addresses advanced topics and requires students to integrate knowledge, think critically, and perform an open-ended project. Both computer science majors and non-majors will benefit from the course because of its multi-disciplinary underpinnings.

IV. PREREQUISITES AND COREQUISITES

There are no specific prerequisites or corequisites, but the catalogue statements on prerequisites associated with course level are applicable. Prerequisites are not practical for this course because students will be from a wide variety of disciplines.

V. TEXTS AND SPECIAL TEACHING AIDS

There will be no required texts for this course (the field is very new and is changing rapidly.) Resources for the class will mainly come from required readings, available online or in a course packet. These may include:

· Brooks, Frederick. WHAT'S REAL ABOUT VIRTUAL REALITY? Los Alamitos, CA: IEEE Computer Graphics & Applications, 1999. pp. 16-27.

· Cruz-Neira, Carolina, Daniel Sandin, and Thomas A. Defanti. SURROUND SCREEN PROJECTION-BASED VIRTUAL REALITY: THE DESIGN AND IMPLEMENTATION OF THE CAVE. Proceedings of ACM SIGGRAPH, 1993. pp. 135-142.

· Darken, Rudolph, John Libert. WAYFINDING BEHAVIORS AND STRATEGIES IN LARGE VIRTUAL WORLDS. Proceedings of CHI, 1996. pp. 142-149.

Special teaching aids will include online lecture notes, hardware (e.g. head-mounted displays, the CAVE, tracking systems, input devices) and software (e.g. the DIVERSE toolkit, 3D studio Max) found in the virtual environments laboratory in Torgersen Hall. Web sites for VE research or industry may also be used for background material.

VI. Syllabus

	Percent of Course
1. Introduction to VEs	5
2. VE technology	15
Visual displays	
Other displays	
Tracking devices	
Other input devices	
3. Current applications of VEs	10
4. Computer graphics for VEs	15

Real-time 3D graphics	
3D modeling	
Level of detail (LOD)	
Collision detection	
5. 3D Human-computer interaction	20
3D interaction techniques for navigation, selection, manipulation, and system control	
3D user interface metaphors	
6. Evaluation and metrics for VEs	10
Usability evaluation in VEs	
Task performance	
User preference metrics	
Immersion and presence	
Quality of service	
7. VE software systems and standards	10
8. Collaborative and distributed VEs	5
9. Future applications of VEs	10
	100

VII. OLD (CURRENT) SYLLABUS

N/A

VIII. CORE CURRICULUM GUIDELINES

N/A