

CS4188: VIRTUAL REALITY

Effective Term

Semester A 2023/24

Part I Course Overview

Course Title

Virtual Reality

Subject Code

CS - Computer Science

Course Number

4188

Academic Unit

Computer Science (CS)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

CS2303 Data Structures for Media or
CS3334 Data Structures or
EE3206 Java Programming and Applications

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

Virtual reality emphasizes on the construction of interactive 3D virtual/mixed environments, and how to interact within such environments through different sensory channels, such as audio, vision and gesture. Virtual Reality has many applications. The most popular ones include 3D computer games and virtual walkthrough, which have attracted a lot of attention. This course aims at introducing virtual reality techniques and their applications.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Identify the important characteristics of different virtual reality techniques.		x		
2	Evaluate and critique different types of virtual reality hardware systems.			x	
3	Evaluate and critique different types of virtual reality applications.			x	
4	Apply virtual reality techniques to develop an application.			x	

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

TLAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	The lecture will focus on the introduction and evaluation of virtual reality technologies and their applications.	1, 2, 3	3 hours/week
2	Tutorial	Students are required to work on different exercises and case studies that are relevant to virtual reality technologies and applications. Some of the tutorial exercises will involve evaluation and design of virtual reality technologies.	1, 3	8 hours/semester

3	Project	Students apply suitable virtual reality techniques to develop applications.	2, 3, 4	3 hours/week for 7 weeks
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Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quiz	1, 2	20	
2	Course Project	2, 3, 4	30	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination AND 30% of the maximum mark of the course project must be obtained.

Assessment Rubrics (AR)**Assessment Task**

Quiz

Criterion

Capacity in understanding the key concerns of virtual reality techniques

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Note even reaching marginal levels

Assessment Task

Course Project

Criterion

Ability to apply virtual reality techniques to develop an application

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Note even reaching marginal levels

Assessment Task

Examination

Criterion

Ability to evaluate virtual reality techniques and to apply them to some applications

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Note even reaching marginal levels

Part III Other Information

Keyword Syllabus

Immersive VR. Non-immersive VR. Augmented VR. Telepresence. Interaction Techniques. Real-time rendering Techniques. Physically Based Modeling. Motion Capture. Tracking Techniques. Display Systems. Virtual Reality Applications. Graphics Systems.

Syllabus

- Virtual Reality Technologies
Overview of input and output devices for VR: head-mounted display, data gloves, 3D video capture, 3D displays, CAVE, haptic devices, motion tracking.
- Interaction Techniques in Virtual Reality
3D selection and manipulation techniques, 3D user interface design and evaluation, gesture recognition and tangible interfaces.
- Virtual Environments
Real-time rendering techniques, visibility determination, motion prediction, motion synchronization.

- Software Platforms
Scene graph, Unity3D, Unreal Engine, jMonkey Engine.
- Applications of Virtual Reality
Applications of VR in different areas such as training, simulation and information visualization.

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	G. Burdea and P. Coiffet, “Virtual Reality Technology,” Second Edition, Wiley-Interscience, 2003.
2	Mel Slater, Anthony Steed, and Yiorgos Chrysanthou, “Computer Graphics and Virtual Environments,” Addison Wesley, 2002.
3	Jason Jerald, “The VR Book: Human-Centred Design for Virtual Reality,” ACM, 2015.
4	Jeff W. Murray, “Building Virtual Reality with Unity and Stream VR,” CRC Press, 2017.
5	Mitch McCaffrey, “Unreal Engine VR Cookbook: Developing Virtual Reality with UE5,” Addison-Wesley Professional, 2017.