Software Engineering Concepts for AR/VR

Module Information

2022.02, Approved

Summary Information

Module Code	7148COMP
Formal Module Title	Software Engineering Concepts for AR/VR
Owning School	Computer Science and Mathematics
Career	Postgraduate Taught
Credits	20
Academic level	FHEQ Level 7
Grading Schema	50

Teaching Responsibility

LJMU Schools involved in Delivery
Computer Science and Mathematics

Learning Methods

Learning Method Type	Hours
Workshop	44

Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
SEP-CTY	CTY	September	12 Weeks

Aims and Outcomes

Aims	(i) To compare and contrast architectural approaches to building AR/VR Applications. (ii) To critically appraise the Software Architectures and Algorithmic Principles which underpin modern AR/VR Applications.(iii) To practically apply the structures and technologies of AR/VR Middleware in tandem with a modern game engine. (iv) To assimilate data and resources from Enterprise software into an AR/VR application for visualisation purposes. (v) To understand the deployment of software solutions across a range of AR/VR related hardware. (vi) To provide opportunity for students to design and develop mixed reality solutions.

After completing the module the student should be able to:

Learning Outcomes

Code	Number	Description
MLO1	1	Critically appraise the core algorithms that underpin a specific class of AR/VR problems.
MLO2	2	Evaluate the software and hardware requirements for integrating AR/VR into an enterprise application.
MLO3	3	Design and develop new application functionality and AR/VR Techniques using modern game engine methodologies and data structures.
MLO4	4	Apply suitable programming techniques with AR/VR related game technologies to solve problems specific to mixed reality applications.
MLO5	5	Practically apply a set of middleware and APIs to incorporate domain-specific data and resource into a VR/AR application.

Module Content

Outline Syllabus	AR/VR Concepts: • Defining Augmented Reality and Virtual Reality; Reality to Virtuality continuum. • Mixed Reality: Definition, Augmented Telepresence, Taxonomy, Issues associated to Mixed Reality, Applications of Mixed Reality Technology.• Sensory Augmentation: Sound, Stereoscopic display, Force Feedback Simulation, haptic devices. User input: Viewer and object tracking, Pose and gesture recognition, Motion Capture, Accelerometers, Fiducial markers, User interface issues.• Virtual Reality and Virtual Environments: The historical development of VR: Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality.• Computer Vision and Augmented Reality• Software SDKs, APIs and Middleware for Virtual Reality• Software SDKs, APIs and Middleware for Augmented Reality• Mobile and Tablet-Based AR. • Consumer Virtual Reality HMDs, Commercial Virtual Reality HMDs, Holographic Displays, CAVEs• AR/VR on the Web.AR/VR Development: • Software Engineering Principles for structuring real-time AR/VR Applications.• Game Engines vs AR/VR Application Solutions. • Core Game Engine API usage and the principles of interaction event-driven software.• Asset Management, Asset Conditioning and Data Import/Export.• Enterprise Application Data and embedding it into AR/VR.• AR/VR Frameworks and their common components.• Application Architecture Tiers: 3RD Party SDKs; Core Systems; Platform Independence; Rendering, Physics Subsystems; Application Data Foundations; Visual Effects System; Application-Specific Subsystems;• Soft vs. Hard Architectures: Scripting Languages• Feedback Models: User Interfaces and Orthographic/Perspective Interface• Logical and Spatial Scene Structures• Spatial Data Structures and Visibility Determination • Physics in an AR/VR Context.• Broad and Narrow Phase Collision Detection and Response.• Material Systems and Rendering • Data-Driven AR/VR Development
Module Overview	This module will introduce you to the Mixed Reality domains, providing both a theoretical perspective on the classification of virtuality and reality, and the associated hardware and software requirements.
	Students will be exposed to the current state of the art in AR/VR development by evaluating the hardware, software and middleware requirements of a modern AR/VR solution.
	Students will learn the software engineering principles and core algorithms which are used to implement Augmented Reality/Virtual Reality applications using aspects of a modern game engine.
	We will focus on the architectural layers of a modern game engine and their relevance to building AR/VR Solutions in tandem with how we integrate AR/VR SDKs into a modern engine and deploy software to AR/VR supporting devices.
	We will look at various architectural design strategies and provide in-depth coverage of various core modules and tiers within a game engine. This involves applying realtime programming techniques and data structures, and practically applying them to develop mixed reality applications.

Additional Information	This module will introduce the student to the Mixed Reality domains, providing both a theoretical perspective on the classification of virtuality and reality, and the associated hardware and software requirements.Students will be exposed to the current state of the art in AR/VR development by evaluating the hardware, software and middleware requirements of a modern AR/VR solution. Students will learn the software engineering principles and core algorithms which are used to implement Augmented Reality/Virtual Reality applications using aspects of a modern game engine.We will focus on the architectural layers of a modern game engine and their relevance to building AR/VR Solutions in tandem with how we integrate AR/VR SDKs into a modern engine and deploy software to AR/VR supporting devices. We will look at various architectural design strategies and provide in-depth coverage of various core modules and tiers within a game engine. This involves applying real-time programming techniques and data structures, and practically applying them to develop mixed reality applications.

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Reflection	Technical Analysis	40	0	MLO1, MLO2
Practice	Application Enhancement	60	0	MLO3, MLO4, MLO5

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
John Carr	Yes	N/A

Partner Module Team

Contact Name	Applies to all offerings	Offerings