Advanced Topics in Virtual Reality

Module Information

2022.01, Approved

Summary Information

Module Code	7152COMP
Formal Module Title	Advanced Topics in Virtual Reality
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
Lecture	11
Workshop	22

Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
JAN-CTY	CTY	January	12 Weeks

Aims and Outcomes

Aims	(i) To develop advanced theoretical and practical research skills in Virtual Reality (ii) To develop a critical appreciation of the theoretical and practical issues related to Virtual Reality. (iii) To understand the Human Physiological and Neuro Perception issues that affect how Virtual Reality is perceived by users. (iv) To develop student's appreciation of a variety of approaches to visualise data in a Virtual Reality context. (v) To provide knowledge of the characteristics of data that lend themselves to a Virtual Reality based representation. (vi) To enable students to use state-of the art technologies and hardware in the development of Virtual Reality applications. (vii) To practically apply state of the art development techniques in order to synthesise a VR solution.

After completing the module the student should be able to:

Learning Outcomes

Code	Number	Description
MLO1	1	Use a range of technologies, algorithms and associated data structures and choose an appropriate architecture for a Virtual Reality Application.
MLO2	2	Employ advanced skills in Virtual Reality development to effectively visualise data in a Virtual Reality setting.
MLO3	3	Make informed and critical decisions in the architecture of the VR Application for a particular domain context.
MLO4	4	Demonstrate a deep and systemic understanding of interrelationships between VR Research Topics and associated development techniques.
MLO5	5	Critically evaluate the effectiveness of a chosen VR Data Visualisation Technique.

Module Content

Outline Syllabus	Virtual Reality Topics:• Advances in Virtual Reality Hardware• HMD Tracking, Motion Tracking and Calibration• Floor and Interaction Space Tracking and Frame of Reference, Camera Aging and Prediction, Obstacle Detection.• Neuro Perception: Optical Physiology, Marr's Hypothesis, Optical Illusions, Interpupillary Distance, Depth Perception, Visual Cues, Achieving a Sense of Presence, Psychophysical effects.• Stereoscopic Rendering Principles, Frame Buffers, Anti-Aliasing• Visual Artefacts: Stitching/Tearing/Judder• Projection and Display Comfort: Parallax, Convergence and Divergence• Real-time Rendering Architectures for VR: Forward vs Deferred Rendering, Foveated Rendering• Frame Rates, Latency and Reprojection• Orthographic vs Billboarded User Interfaces• Distortion Mapping• 3D Object Projection and UI Frameworks for VR.• Post Processing and Non Photo Realistic Rendering via Materials.• Photogrammetry Techniques.• Advances in VR Middleware• Advances in VR Game Engine APIs• Emerging VR Fields of Study.Data Visualisation: • Background, application, importance and technology.• Data & Information Representation: Data type, statistical data, time series data, data format etc. • Principles of Graphic Design: Colour, alignment, balance, consistency, contrast, proximity, gestalt etc. • Type of Visualisation: Data visualisation, information visualisation, concept visualisation, strategy • Visualisation Development: Visualisation design, interaction design, data acquisition, data interpretation (parsing) visualisation development – programming, testing and deployment.
Module Overview	This module explores the theoretical and technical domains that underpin the current state of the art in Virtual Reality development. From fundamental fields of study such as Data Visualisation and Neuro Perception, through to hardware concerns, visual fidelity and real-time rendering approaches required to achieve smooth, immersive environments, you will evaluate and practically apply the latest development techniques to produce a Virtual Reality Visualisation system.
Additional Information	This module explores the theoretical and technical domains that underpin the current state of the art in Virtual Reality development. From fundamental fields of study such as Data Visualisation and Neuro Perception, through to hardware concerns, visual fidelity and real-time rendering approaches required to achieve smooth, immersive environments, students will evaluate and practically apply the latest development techniques to produce a Virtual Reality Visualisation system.

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Technology	Prototype	80	0	MLO1, MLO2, MLO3
Portfolio	Presentation	20	0	MLO4, MLO5

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Liang Men	Yes	N/A

Partner Module Team

Contact Name	Applies to all offerings	Offerings