

CS 4743: Immersive Computing

Required Course: Elective

Course Number: CS 4743

Course Name: Immersive Computing

Credit Hours: 3

Lecture Hours: 3

Lab Hours: 0

Instructors: Dr. Blayne E Mayfield

Book Title(s): *Virtual Reality Technology and Applications*

Book Author(s): Mihelj, Novak and Begus

Book Year(s):

Additional resources:

- Unity in Action: Multiplatform game development in C#, 2nd edition by Joseph Hocking; Manning Publications (2018); ISBN 978-1-61729-496-9
 - C# Programming Yellow Book by Rob Miles, 2016 edition; Department of Computer Science, University of Hull
 - Immersive computing, Unity, or other eBooks available at the OSU Library site.
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Course Description: Survey the history and state-of-the-art of immersive computing, aka VAMR (virtual/augmented/mixed reality) computing. Tools and techniques to develop for a variety of target platforms. Human physiological factors that affect the design and development of immersive systems. The relationship of immersive computing with IoT (Internet of Things). Construction of virtual environments and the tracking of real and virtual objects. Applications of immersive computing to solve real-world problems.

Course Prerequisites: CS 2133 (Computer Science II), and CS 3653 (Discrete Mathematics for Computer Science), and CS 2433 (C/C++ Programming)

Course Goals:

- Survey the history, state-of-the-art, and future of immersive computing, a.k.a VAMR (virtual, augmented, and mixed realities), a.k.a. XR (extended reality).

- Learn to use appropriate tools and techniques to develop for a variety of target platforms. Examine the human physiological factors that affect the design and development of immersive systems.
- Investigate the relationship between immersive computing and IoT (Internet- of-Things). Learn about the construction of virtual environments and tracking between real and virtual objects. Study the applications of immersive computing to solve real-world problems.

Student Outcomes:

Student Outcomes	Course Outcomes
1	<ul style="list-style-type: none"> • Understand certain physiological factors - such as visual, acoustic, and haptic modalities – and their effect on the creation of extended reality applications.
2	<ul style="list-style-type: none"> • Learn or extend knowledge of programming techniques, languages, and libraries as they are used to develop virtual, augmented, and mixed reality applications. • Build necessary skills for design and development using extended reality hardware, such as VR headsets, MR headsets, and mobile devices.
3	<ul style="list-style-type: none"> • Design and develop projects in such a way that they are clearly and effectively documented, including embedded code comments. • Reference assets that are used within the applications.
5	<ul style="list-style-type: none"> • Lead or serve on a team that designs and develops extended reality applications. • Communicate effectively with team members and the client.
6.	<ul style="list-style-type: none"> • Use appropriate design patterns such as abstract factories to develop effective applications.

Course Topics:

Knowledge Area	Total Hours of Coverage
Human-Computer Interaction (HCI)	6
Programming Languages (PL)	8
Software Development Fundamentals (SDF)	9
Software Engineering (SE)	8
Systems Fundamentals (SF)	7
Social Issues and Professional Practice (SP)	2

Knowledge Area	Knowledge Unit	Topics Covered	Hours
SP	Background information	History, state-of art, and future of	2

		extended reality hardware and software	
HCI	Sensation and perception	Visual, acoustic, and haptic modalities.	6
PL	Development tools	Game development engines, extended reality libraries, programming for extended reality	8
SDF	Markers and markerless systems	Fiducials, 3D markers, natural markers.	2
SF	Extended reality hardware and usage	Head-mounted displays for virtual and mixed realities, mobile devices for augmented reality, and positional tracking	4
SDF	3D computer graphics and simulation	Homogeneous transformations, collision detection and handling, and lighting and shadows	4
SDF	Techniques for extended reality	Waypoint systems, navigation meshes, ray casting, particle systems and object proxies	3
SF	Artificial Intelligence for extended reality	Path-finding, path-following, and semi-autonomous agents	3
SE	Working as part of a design and development team	Design, development, and collaboration as part of a team.	8