WOODBURY UNIVERSITY
FOUNDED IN 1884

DEPARTMENT OF
APPLIED COMPUTER SCIENCE

TECH 3707
3 Units

Advanced Mixed Reality

1st Year | 2nd Year | 3rd Year | 4th Year

Course Description
This class will explore various platforms for the design and creation of AR and VR applications. Emphasizing hands-on experimentation, this experiential studio is meant to be a collaboration between both programmers and designers to research and develop new paradigms for user experience and new pipelines for the creation of 3D content. Using real time game engines, and various hardware equipment and mobile devices, students will work individually and in teams to practically apply novel design principles to build new applications, culminating in a semester project demonstrating a critical approach to designing for these emerging forms of media.

Term
Fall 2018

Instructor
Ivaylo Getov
ivaylo.getov@woodbury.edu

Prerequisite
Mixed Reality Studio

Required Text
None

Format

Mixed Reality is a rapidly evolving field, both professionally and pedagogically. Encompassing VR, AR, and any number of trendy buzzwords such as "experiential" and immersive, it stretches across disciplines and can be informed by a variety of expertise. In Mixed Reality Studio, we created an environment where students can experiment with new techniques and practices, which are themselves in constant flux as the technology changes and finds its audience. The emphasis in the beginner class was to develop a functional familiarity with a wide breadth of topics.

Advanced Mixed Reality will build on that familiarity by narrowing its scope, focusing deeper on specific implementations of Mixed Reality and culminating in a fully developed AR project for general public use.

The class will be structured as a series of **Chapters**, each building on the last:

- **Chapter 0** - *Recap topics*
  Focused on making sure everyone is back up to speed and re-familiarized with Unity and C# development.

- **Chapter 1** - *Expanding on Fundamentals*
  A series of class discussions, lectures, and exercises. Allowing us to dive deep into specific concepts and explore techniques.

- **Chapter 2** - *Interactive AR*
  We will be developing a mobile AR application based on the Vuforia framework

- **Chapter 3** - *Shared AR Experience*
  We will build on the previous project to develop a multi-user AR project

As before, we will be on our feet. We will move fast and break things so that we learn how to fix them. We may venture outside and get our hands dirty. You will be asked to split into groups - others may be relying on you to complete a portion of a larger project and it will be your responsibility to deliver.

Also, as before, this course is new and in flux. The schedule below is tentative and will _very likely_ change. Please check this git repository each week to find the most up to date schedule and topics.

Outcomes

Participants will show proficiency in the following student learning outcomes.

1. Develop understanding of Mixed Reality design and development concept and practices
2. Develop familiarity with a cross-section of Mixed Reality hardware.
3. Develop proficiency designing for *experience* and *space* rather than pixels.
4. Complete hands-on exercises and projects to demonstrate familiarity with concepts of Mixed Reality.

Content

The following course content will be covered.

1. Intermediate/Advanced concepts in the Unity game engine.
2. Intermediate Programming Concepts, implemented in C# and JavaScript
3. The Current State of Virtual/Augmented/Mixed Reality.
4. Designing for space instead of screens.
5. Thorough Hands-on work Apple iOS/ARKit, Android/ARCore, HTC Vive, and Microsoft Hololens
6. Basic User Interface (UI) and User Experience (UX) design.
7. Introduction to shared project-management methods (git, trello, etc.)

Assignments

Students will complete the following requirements, assignments, and projects.

1. In-class group discussions and exercises

2. Project 1 - Interactive AR

3. Final Project - Shared AR Experience

4. Assigned Reading TBD

Materials

The following materials of instruction are required.

1. None

Schedule

The following weekly schedule is subject to instructor revision.

Session 01
08/24/18

Chapter 0 - Recap Basics

- Introductions, course overview, housekeeping
- Recap/Refresher of AR/VR/MR design principles
  - A brief history
  - Designing in the real world
- Discuss **AR** vs **VR**
  - Go over new technology and news from the summer
- Setting up our tools:
  - Unity, XCode
- Unity/C# Intensive - Shaking out all the summer cobwebs

Session 02
08/31/18

Chapter 0 - Recap Basics

- Recap/Refresher Continued
- Unity and C# Topics TBD
- In-class programming exercises

Session 03
09/07/18

Chapter 1 - Expanding Fundamentals

- Guest Lecture: Developing Public AR Experiences
- Discussion

Session 04
09/14/18

Chapter 1 - Expanding Fundamentals

- Guest Lecture: AR as Social Interaction
- Discussion/Exercise

Session 05
09/21/18

Chapter 1 - Expanding Fundamentals

- Guest Lecture: TBD
- Discussion/Exercise

Session 06
09/28/18

Chapter 1 - Expanding Fundamentals

- Welcome to the command line!
  - Using **`git`** and **`.gitignore`**
  - Setting up Unity for git

Session 07
10/05/18

Chapter 2 - Interactive AR

- Project Intro
- Discussion of virtual vs real-world coordinate systems
  - How do our devices know about the real world?
- Introducing **`Vuforia`**
  - Making our first marker-based AR app

Session 08
10/12/18

Chapter 2 - Interactive AR

- Intermediate Unity/C#:
  - Event-driven vs Loop-driven code
  - Responding to image-recognition events

Session 09
10/19/18

Chapter 2 - Interactive AR

- Interactive AR Project workshop and notes
  - Topics TBD as needed

Session 10
10/26/18

Chapter 3 - Shared AR Experience

- Project Intro
- Setting up multi-client communication
- Introduction to **`node.js`**
- Setting up a node server with **`socket.io`**

Session 11
11/02/18

Chapter 3 - Shared AR Experience

- Designing shared
  - Discussion of design and graphics for group experience
- Setting standards
  - Discussion of **`API`** definition common to everyone's project
- Intermediate C#
  - Creating **`Interfaces`** for shared C# code modules

Session 12
11/09/18

Chapter 3 - Shared AR Experience

- Final Project workshop and notes
  - Topics TBD as needed

Session 13 **11/16/18**

Chapter 3 - Shared AR Experience

- Final Project workshop and notes
  - Topics TBD as needed

NO CLASS **11/23/18**

Thanksgiving Holiday

Session 14 **11/30/18**

FINAL

- Final Project presentation and discussion
- Class Topic Recap
  - Revisit Concepts and where to go from here
- *Final Project Public Demo Day TBD*

Assessment

Students will be evaluated based on the following criteria.

Evaluation Standards

1. Active and verbal participation in in-class discussion to demonstrate completion and understanding of assigned reading.
2. Careful attention to execution, technique and completion of projects
3. Personal challenge and effort in project development
4. Deadline compliance
5. Performance in student learning outcomes

Activity	Points
Participation, attendance, exercises	**50**
Project 1 - Interactive AR	**20**
Final Project - Shared AR Experience	**30**
Total	**100**

Final Grade Criteria | Studio Course		
A	93-100%	Clearly stands out as **EXEMPLARY** performance and exhibits consummate command of learning outcomes
A-	90-92%	
B+	87-89%	Grasps subject matter at a **PROFICIENT** level, considered to be good to very good, and exhibits command of learning outcomes
B	83-86%	
B-	80-82%	
C+	77-79%	Demonstrates an **ACCEPTABLE** comprehension of the subject matter, and exhibits satisfactory understanding of the learning outcomes
C	73-76%	
C-	70-72%	Quality of work is below average and **INADEQUATE**, and exhibits only minimal understanding of the learning outcomes. Skills are not sufficient to continue in the studio sequence.
D+	67-69%	
D	60-66%	
F	59%	Quality and quantity of work is **UNACCEPTABLE** and does not exhibit understanding of the learning outcomes

Guidelines

Students are expected to observe the following class guidelines.

1. **Students are responsible for information missed due to tardy or absence.**
2. Late or incomplete assignments and projects are discouraged and will adversely affect the students overall grade.

Policies

Please review the following policies.

Attendance

Regular and prompt attendance at all university classes is required. The instructor is not obligated to assign extra work or to prepare additional examinations for classes missed. It is understood that when 15% of the class time has been missed, the student's absence rate is excessive.

Accommodations for Disabilities

Woodbury University is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. Students desiring accommodations due to a physical, learning or psychological disability must first complete an *Accommodations Request Form*, which can be downloaded from http://go.woodbury.edu, and found under "Academic Resources." Accommodations cannot be granted prior to the instructor's receipt of a *Notification of Special Needs Release Form* from the Disabilities Coordinator. Accommodations are never provided retroactively. (For more information, contact the Disabilities Coordinator in the Whitten Center (818) 394-3345.)

Archive Policy
Students are required to include a Woodbury ID label containing the following information on the back of all projects submitted to the instructor:

- class number
- class name
- semester
- instructor's name
- student's name
- student's contact information

Media should be labeled on the package, and name, class and year should be included on the media/ disc. A printable pdf of the Woodbury ID label is available on the portal in the MCD: Animation link on the Student page. Blank Avery labels may be purchased at the bookstore. Projects will not be accepted without this information. The university reserves the right to retain student work for archival purposes. See the Woodbury Catalog for the official policy on archiving of student work.

Outsourcing
Outsourcing is defined as obtaining created work or acquiring outside services to produce created works in any aspect of course-assigned project development and/or production. This includes work or services that are paid for and work or services that are not. It includes work or services from any individual including fellow students and outside professionals. Outsourcing of project production elements is prohibited unless specifically stated in your course syllabus and/or guidelines. Outsourced elements must be acknowledged through complete, accurate, and specific references. The intellectual authorship of the project must belong to the submitting students. Outsourcing will not be permitted under following circumstances:

1. If a program or course learning outcome is designed to assess the production of physical or digital components and outsourcing involves these components.
2. If the effect of outsourcing changes or impacts the students' original design, or creative vision, or process at any stage of the project from development to final production or installation.
3. If the effect of outsourcing changes or impacts the students' original design, or creative vision, or process at any stage of the project from development to final production or installation.

Academic Honesty Policy
Because the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required at Woodbury University. The University views academic dishonesty as one of the most serious offenses that a member of our community can commit. Adherence to the Academic Honesty Policy reflects the commitment of our community to the ideals of learning, research, and scholarship. *The full policy and examples of academic dishonesty can be found on the Student Portal.*

Definitions of Academic Dishonesty
Cheating: Cheating is the act or attempted act of deception by which an individual seeks to misrepresent that he/she has mastered information on an exercise that he/she has not mastered.
Fabrication: Fabrication is the use of invented information or the falsification of research or other findings in an academic exercise.
Facilitating Academic Dishonesty: Facilitating academic dishonesty is intentionally or knowingly helping or attempting to help another commit an act of academic dishonesty.

Plagiarism: Plagiarism is the submission of another's work as one's own, without adequate attribution. When an individual submits work that includes the words, images, music, ideas, or data of others, the source of the information must be acknowledged through complete, accurate, and specific references, and, if verbatim statements are included, through quotation marks or indentation as appropriate. By placing his/her name on work submitted, the author certifies the originality of all work not otherwise identified by appropriate acknowledgements. Plagiarism covers unpublished as well as published sources.