CAP 6110: Augmented Reality Engineering
3 Credit Hours

Course Syllabus

Course Information

<table>
<thead>
<tr>
<th>Course Number:</th>
<th>CAP 6110</th>
<th>Term:</th>
<th>Spring 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Section:</td>
<td>0001</td>
<td>Class Times:</td>
<td>TuTh 9:00am – 10:15am</td>
</tr>
<tr>
<td>Course Name:</td>
<td>AR Engineering</td>
<td>Class Zoom:</td>
<td><a href="https://ucf.zoom.us/j/94898929642">https://ucf.zoom.us/j/94898929642</a></td>
</tr>
<tr>
<td>Prerequisite(s):</td>
<td>CAP 5115 VR Engineering</td>
<td>Class Location:</td>
<td>BA1 147</td>
</tr>
</tbody>
</table>

Contact Information

<table>
<thead>
<tr>
<th>Instructor:</th>
<th>Dr. Ryan P. McMahan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office Hours:</td>
<td>TuTh 10:30am – 12:00pm</td>
</tr>
<tr>
<td>Office Zoom:</td>
<td><a href="https://ucf.zoom.us/j/96078711941">https://ucf.zoom.us/j/96078711941</a></td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:rpm@ucf.edu">rpm@ucf.edu</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>(407) 823-4994</td>
</tr>
</tbody>
</table>

Course Description

Augmented reality, tracking, situated visualization, simultaneous localization and mapping, AR interactions, calibration, registration, occlusion, photometric registration, common illumination, diminished reality, viewpoint guidance, multiple perspectives, collaboration.

Student Learning Outcomes

Students are expected to achieve the following by using current tools and applying best practices:

- Design and implement an AR application with tracked targets.
- Design and implement an AR application with visual coherence.
- Design and implement an AR application with situated visualization.
- Design and implement an AR application with interactions.
- Design and implement an AR application for navigation.
- Design and implement an AR application for collaboration.
## Course Activities

### Calendar

<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday</th>
<th>Thursday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Overview</td>
<td>Tracking</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>2</td>
<td>Object Tracking</td>
<td>Indoor Tracking</td>
<td>Homework 1 Due</td>
</tr>
<tr>
<td>3</td>
<td>Outdoor Tracking</td>
<td>Visual Coherence</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>4</td>
<td>Photogrammetry</td>
<td>Common Illumination</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>5</td>
<td>Diminished Reality</td>
<td>Situated Visualization</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>6</td>
<td>X-Ray Visualization</td>
<td>Spatial Manipulation</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>7</td>
<td>Information Filtering</td>
<td>Interactions</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>8</td>
<td>Gestures</td>
<td>Tangibles</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>9</td>
<td>Modeling</td>
<td>Free-Form Modeling</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>10</td>
<td>Annotations</td>
<td>Navigation</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>11</td>
<td>Route Guidance</td>
<td>Multiple Perspectives</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>12</td>
<td>Transitional Interfaces</td>
<td>Collaboration</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>13</td>
<td>Remote Collaboration</td>
<td>Video Sharing</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>14</td>
<td>Spring Break (NO CLASS)</td>
<td>Spring Break (NO CLASS)</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>15</td>
<td>Final Exam Review</td>
<td>Course Debrief</td>
<td>Visit Webcourses@UCF</td>
</tr>
<tr>
<td>16</td>
<td>Study Day (NO CLASS)</td>
<td>FINAL EXAM</td>
<td>Visit Webcourses@UCF</td>
</tr>
</tbody>
</table>

**Final Exam will be Thursday, April 29, 2021 from 9:00am – 9:50am**

### Important Dates

- Friday, January 15, 2021: Drop/Swap Deadline
- Monday, January 18, 2021: Martin Luther King Jr. Day (no classes)
- Friday, March 26, 2021: Withdrawal Deadline
- Sunday-Sunday, April 11-18, 2021: Spring Break (no classes)
- Tuesday, April 27, 2021: Study Day (no classes)
- Thursday, April 29, 2021: Final Exam (9:00am – 9:50am)

### Assignments

Students are expected to complete and submit the following assignments through Webcourses@UCF. Specifications and details for each assignment can be found on Webcourses@UCF.

- Homework 1: Design and implement an AR application with tracked targets.
- Homework 2: Design and implement an AR application with visual coherence.
- Homework 3: Design and implement an AR application with a situated visualization.
- Homework 4: Design and implement an AR application with interactions.
- Homework 5: Design and implement an AR application for navigation.
- Homework 6: Design and implement an AR application for collaboration.

### Final Exam

Students are expected to take a final examination on all course content during the designated final exam period. The final exam will take place on Thursday, April 29, 2021 from 9:00am to 9:50am.
Assessment and Grading Procedures

Grading Methods
A point-based grading system will be used with 100 total points distributed among quizzes, assignments, and the final exam, as follows:

- Quizzes 15 points
- Homework 1 10 points
- Homework 2 10 points
- Homework 3 10 points
- Homework 4 10 points
- Homework 5 10 points
- Homework 6 10 points
- Final Exam 25 points

The following grading scale will be employed on the final point totals:

- A 94 or above
- A- 90-94
- B+ 87-90
- B 84-87
- B- 80-84
- C+ 77-80
- C 74-77
- C- 70-74
- D+ 67-70
- D 64-67
- D- 61-64
- F Below 61

Make-up Assignments and Exams
Per university policy, students must be allowed to turn in make-up work (or an equivalent, alternate assignment) for university-sponsored events, religious observances, or legal obligations (such as jury duty). In these instances, students must also be excused from class without penalty. Otherwise, make-up assignments and exams will not be accepted.

Attendance/Participation
Attendance and participation in class meetings are NOT required.

Extra Credit
No extra credit will be offered unless otherwise noted in an assignment.

Grade Dissemination
All grades will be disseminated through Webcourses@UCF.

Course Materials and Resources

Required texts
**Required materials**
- Unity 2019.4.17f1 (LTS)
- Vuforia 9.6.4
- AR Foundation 4.0.9
- A Vuforia-supported device: https://library.vuforia.com/platform-support/vuforia-engine-recommended-devices.html

**Policy Statements**

**Required Statement Regarding COVID-19**

*University-Wide Face Covering Policy for Common Spaces and Face-to-Face Classes*
To protect members of our community, everyone is required to wear a facial covering inside all common spaces including classrooms:
https://policies.ucf.edu/documents/PolicyEmergencyCOVIDReturnPolicy.pdf. Students who choose not to wear facial coverings will be asked to leave the classroom by the instructor. If they refuse to leave the classroom or put on a facial covering, they may be considered disruptive (please see the Golden Rule for student behavior expectations). Faculty have the right to cancel class if the safety and well-being of class members are in jeopardy. Students will be responsible for the material that would have been covered in class as provided by the instructor.

*Notifications in Case of Changes to Course Modality*
Depending on the course of the pandemic during the semester, the university may make changes to the way classes are offered. If that happens, please look for announcements or messages in Webcourses@UCF or Knights email about changes specific to this course.

*COVID-19 and Illness Notification*
Students who believe they may have a COVID-19 diagnosis should contact UCF Student Health Services (407-823-2509) so proper contact tracing procedures can take place.

Students should not come to campus if they are ill, are experiencing any symptoms of COVID-19, have tested positive for COVID, or if anyone living in their residence has tested positive or is sick with COVID-19 symptoms. CDC guidance for COVID-19 symptoms is located here: https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

Students should contact their instructor(s) as soon as possible if they miss class for any illness reason to discuss reasonable adjustments that might need to be made. When possible, students should contact their instructor(s) before missing class.

*In Case of Faculty Illness*
If the instructor falls ill during the semester, there may be changes to this course, including having a backup instructor take over the course. Please look for announcements or mail in Webcourses@UCF or Knights email for any alterations to this course.

*Course Accessibility and Disability COVID-19 Supplemental Statement*
Accommodations may need to be added or adjusted should this course shift from an on-campus to a remote format. Students with disabilities should speak with their instructor and should contact sas@ucf.edu to discuss specific accommodations for this or other courses.
Using Zoom for Remote Instruction
Because of the continued remote instruction requirement due to the COVID-19 pandemic, this course will use Zoom for some synchronous (“real time”) class meetings. Meeting dates and times will be scheduled through Webcourses@UCF and should appear on your calendar.

Please take the time to familiarize yourself with Zoom by visiting the UCF Zoom Guides at https://cdl.ucf.edu/support/webcourses/zoom/. You may choose to use Zoom on your mobile device (phone or tablet).

Things to Know About Zoom:
- You must sign in to my Zoom session using your UCF NID and password.
- The Zoom sessions are recorded.
- Improper classroom behavior is not tolerated within Zoom sessions and may result in a referral to the Office of Student Conduct.
- You can contact Webcourses@UCF Support at https://cdl.ucf.edu/support/webcourses/, if you have any technical issues accessing Zoom.

Academic Integrity
Students should familiarize themselves with UCF’s Rules of Conduct at https://scai.sdes.ucf.edu/student-rules-of-conduct/. According to Section 1, “Academic Misconduct,” students are prohibited from engaging in:
1. Unauthorized assistance: Using or attempting to use unauthorized materials, information or study aids in any academic exercise unless specifically authorized by the instructor of record. The unauthorized possession of examination or course-related material also constitutes cheating.
2. Communication to another through written, visual, electronic, or oral means: The presentation of material which has not been studied or learned, but rather was obtained through someone else’s efforts and used as part of an examination, course assignment, or project.
3. Commercial Use of Academic Material: Selling of course material to another person, student, and/or uploading course material to a third-party vendor without authorization or without the express written permission of the university and the instructor. Course materials include but are not limited to class notes, Instructor’s PowerPoints, course syllabi, tests, quizzes, labs, instruction sheets, homework, study guides, handouts, etc.
4. Falsifying or misrepresenting the student’s own academic work.
5. Plagiarism: Using or appropriating another’s work without any indication of the source, thereby attempting to convey the impression that such work is the student’s own.
6. Multiple Submissions: Submitting the same academic work for credit more than once without the express written permission of the instructor.
7. Helping another violate academic behavior standards.
8. Soliciting assistance with academic coursework and/or degree requirements.

Responses to Academic Dishonesty, Plagiarism, or Cheating
Students should also familiarize themselves with the procedures for academic misconduct in UCF’s student handbook, The Golden Rule: https://goldenrule.sdes.ucf.edu/. UCF faculty members have a responsibility for students’ education and the value of a UCF degree, and so seek to prevent unethical behavior and respond to academic misconduct when necessary. Penalties for violating rules, policies, and instructions within this course can range from a zero on the exercise to an “F” letter grade in the course. In addition, an Academic Misconduct report could be filed with the Office of Student Conduct, which could lead to disciplinary warning, disciplinary probation, or deferred suspension or separation from the University through suspension, dismissal, or expulsion with the addition of a “Z” designation on one’s transcript.
Being found in violation of academic conduct standards could result in a student having to disclose such behavior on a graduate school application, being removed from a leadership position within a student organization, the recipient of scholarships, participation in University activities such as study abroad, internships, etc.

Let’s avoid all of this by demonstrating values of honesty, trust, and integrity. No grade is worth compromising your integrity and moving your moral compass. Stay true to doing the right thing: take the zero, not a shortcut.

Course Accessibility Statement
The University of Central Florida is committed to providing access and inclusion for all persons with disabilities. Students with disabilities who need access to course content due to course design limitations should contact the professor as soon as possible. Students should also connect with Student Accessibility Services (SAS) (http://sas.sdes.ucf.edu) (Ferrell Commons 185, sas@ucf.edu, phone 407-823-2371). For students connected with SAS, a Course Accessibility Letter may be created and sent to professors, which informs faculty of potential course access and accommodations that might be necessary and reasonable. Determining reasonable access and accommodations requires consideration of the course design, course learning objectives and the individual academic and course barriers experienced by the student. Further conversation with SAS, faculty and the student may be warranted to ensure an accessible course experience.

Campus Safety Statement
Emergencies on campus are rare, but if one should arise during class, everyone needs to work together. Students should be aware of their surroundings and familiar with some basic safety and security concepts.

- In case of an emergency, dial 911 for assistance.
- Every UCF classroom contains an emergency procedure guide posted on a wall near the door. Students should make a note of the guide’s physical location and review the online version at http://emergency.ucf.edu/emergency_guide.html.
- Students should know the evacuation routes from each of their classrooms and have a plan for finding safety in case of an emergency.
- If there is a medical emergency during class, students may need to access a first-aid kit or AED (Automated External Defibrillator). To learn where those are located, see https://ehs.ucf.edu/automated-external-defibrillator-aed-locations.
- To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to https://my.ucf.edu and logging in. Click on “Student Self Service” located on the left side of the screen in the toolbar, scroll down to the blue “Personal Information” heading on the Student Center screen, click on “UCF Alert”, fill out the information, including e-mail address, cell phone number, and cell phone provider, click “Apply” to save the changes, and then click “OK.”
- Students with special needs related to emergency situations should speak with their instructors outside of class.
- To learn about how to manage an active-shooter situation on campus or elsewhere, consider viewing this video: https://youtu.be/NIKYajEx4pk.

Campus Safety Statement for Students in Online-Only Courses
Though most emergency situations are primarily relevant to courses that meet in person, such incidents can also impact online students, either when they are on or near campus to participate in other courses or activities or when their course work is affected by off-campus emergencies. The following policies apply to courses in online modalities.

- To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to https://my.ucf.edu and logging in. Click on “Student Self Service” located on the left
side of the screen in the toolbar, scroll down to the blue “Personal Information” heading on the Student Center screen, click on “UCF Alert”, fill out the information, including e-mail address, cell phone number, and cell phone provider, click “Apply” to save the changes, and then click “OK.”

- Students with special needs related to emergency situations should speak with their instructors outside of class.

**Deployed Active Duty Military Students**

Students who are deployed active duty military and/or National Guard personnel and require accommodation should contact their instructors as soon as possible after the semester begins and/or after they receive notification of deployment to make related arrangements.

**Make-Up Assignments for Authorized University Events or Co-curricular Activities**

Students who represent the university in an authorized event or activity (for example, student-athletes) and who are unable to meet a course deadline due to a conflict with that event must provide the instructor with documentation in advance to arrange a make-up. No penalty will be applied. For more information, see the UCF policy at [https://policies.ucf.edu/documents/4-401.pdf](https://policies.ucf.edu/documents/4-401.pdf).

**Religious Observances**

Students must notify their instructor in advance if they intend to miss class for a religious observance. For more information, see the UCF policy at [http://regulations.ucf.edu/chapter5/documents/5.020ReligiousObservancesFINALJan19.pdf](http://regulations.ucf.edu/chapter5/documents/5.020ReligiousObservancesFINALJan19.pdf).