Faculty of Computer Science
Goldberg CS Building, 6050 University Ave.
Tel: 902.494.2093

DALHOUSIE UNIVERSITY

Course Title: Topics in AR/VR
Course Number: CSCI 4262
Course Section: 1
Semester & Year: Winter 2024
Class Day & Time: Mon 2:35pm–5:25pm
Class Location: MC 2107
Lab Day & Time: Tue 5:35pm–6:55pm
Lab Location: Goldberg 127

Credit Value: 3.00

Instructor: Dr. Derek Reilly
Email: reilly@cs.dal.ca
Office Location: MS Teams
Office Hours: by appointment

TAs: Nirmal Adhikari (nr452143@dal.ca)

Course Website: on Brightspace
Course Communication: on Brightspace

IMPORTANT DATES *

- Final withdrawal dates:
  - without academic penalty ("W"): Feb 6
  - with academic penalty ("W"): Mar 6
- Reading week (no classes or labs): Feb 19-23
- Quiz dates: Jan 29, Mar 4, Apr 1
- Assignment due dates: Oct 1, Oct 15, Nov 5
- Project iteration due dates: Oct 20, Nov 17, Dec 7

* quiz, assignment, and milestone dates are subject to change; any changes will be posted on Brightspace

COURSE DESCRIPTION

This course will explore augmented and virtual reality from both theoretical and practical lenses. Specific topics may include: mixed reality, collaboration in AR/VR, immersive analytics, navigation and locomotion in AR/VR, interaction in AR/VR, platforms and toolkits for AR/VR, narrative and gaming, public installations; spatial analysis and related theory, cognitive and psychological aspects including immersion, presence, embodiment, and spatial mental models.

LEARNING OUTCOMES

- Understand AR/VR technologies, including historical developments, current constraints, and emerging potentials.
- Design an interactive AR/VR prototype using current toolkits and platforms.
- Critique and evaluate AR/VR experiences.
- Apply relevant theory to the design and evaluation AR/VR applications.

COURSE RATIONALE

Augmented Reality (AR) and Virtual Reality (VR) technologies are finally becoming available to more people due to the new wave of commercial head-mounted displays that are cheap and powerful. Thanks to this, there is a need for developers capable of making VR and AR applications in various industries like education, arts, marketing, and games. This course provides students with a foundation in technical skills required to work in the VR/AR industry. It also teaches students the history of these technologies and provides the theoretical concepts behind these technologies. Besides this course, students interested in working as developers of VR and AR applications should also learn about user interface design (CSCI 3160 Designing User Interfaces and CSCI 4163 Human-Computer Interaction), and computer graphics (CSCI 3161 Intro Comp Graph & Animation and CSCI 4168 Game Design and Development).

TEXTBOOK

There is no required textbook for the course; assigned readings will be made available on the course website. Lecture slides will be posted on Brightspace.

HARDWARE AND SOFTWARE RESOURCES

VR Headset

Students will have access to an Meta Quest headset (version 2) to deploy and test their prototypes.
Quest requires a Meta account to use. If you do not have or wish to use a Meta account in this course, contact the instructor for an alternative arrangement.

Software

In this class, we will be using a web-based game engine called Babylon.js. Assignments will involve programming using TypeScript, a typed language that transcompiles to JavaScript. Both of these are open-source and will run in major web browsers (e.g., Chrome, Firefox, Edge, Safari). The AR/VR capabilities are best supported in Chrome.
Generative AI tools (e.g., Chat GPT, Copilot) are strictly prohibited in this course.

COURSE EVALUATION

Assignments (3)……..... 30% (10% each)
Quizzes (3) ……..... 30% (10% each)
Project Iterations (3)……..... 30% (10% each)
Participation ……..... 10%

Notes:

- the grade conversion scale in Section 17.1 of the Academic Regulations, Undergraduate Calendar will be used.
- Students who do not pass the quiz component of the course (i.e., <50% average on quizzes) will be subject to a reduction of their final course mark by a full letter grade.
- the participation mark is based on attendance; **attendance will be taken throughout the semester.**

MIDTERM AND FINAL EXAMINATION

There is no midterm or final exam in this course.

POLICY ON LATE ASSIGNMENTS

Unless otherwise specified, assignments and project submissions are expected by noon on the day in which they are due. Each student has 7 late points at the start of the semester, worth a 24-hour extension on any assignment. Late points are to be used due to legitimate absences (e.g. illness), as well as work schedule flexibility. Project submissions must be submitted by the deadline, or else late points will be deducted from each group member. Requests for extensions *are not required* if you have sufficient late points remaining. If you use all late points and anticipate further issues with completing work on time, contact the course instructor to discuss your situation.

COURSE PROJECT

Students will create an AR/VR prototype in groups of 2 or 3. Details about project deliverables and grading will be made available separately.

TENTATIVE CLASS SCHEDULE

***subject to change – Brightspace provides the definitive schedule. See "Important Dates" for due dates.

Week of	Topic	Events
Jan 8	Course introduction. What is AR, VR? A brief history.	
Jan 15	Human perception and AR/VR.	Project announced,
Jan 22	Prototyping AR/VR.	Project groups formed, Assignment 1 due.
Jan 29	AR application design.	Quiz 1.
Feb 5	Applications of AR.	Assignment 2 due.
Feb 12	Cognitive models and AR/VR.	Project iteration 1 due.
Feb 19	Reading Week	
Feb 26	VR application design.	
Mar 4	VR systems and applications.	Assignment 3 due, Quiz 2.
Mar 11	User experience and AR/VR.	Project iteration 2 due.
Mar 18	3D user interfaces.	
Mar 25	Evaluating AR/VR systems.	
Apr 1	Research directions.	Project iteration 3 due, Quiz 3.

COURSE COMMUNICATIONS

Course announcements will be posted on Brightspace and/or to the course mail list, which comprises the instructor's and students' CS email accounts. It is the student's responsibility to check Brightspace and their CS e-mail account on a regular basis. If you do not know how to access your CS e-mail account or Brightspace please contact the CS help desk or read the information located at: http://www.dal.ca/faculty/computerscience/current.html

ACADEMIC STANDARDS

Failure to properly attribute sources in your work will be treated as an academic standards issue and points may be deducted for not following citation requirements. For example, forgetting to quote text taken from other sources, failure to include in-text citations, failure to attribute imported software libraries, failure to attribute resources that assisted you in completing a programming assignment, or a failure to include required information in the citations or references. Please see the resources on proper citation provided by the Dalhousie Writing Center (https://dal.ca.libguides.com/c.php?g=257176&p=5001261).

Please note that if it appears that the error was made with intent to claim other people's work as your own such as a lack of both citations and references, an allegation of plagiarism will be submitted to the Faculty Academic Integrity Officer, which could result in consequences such as a course failure.

STUDENT HEALTH AND WELLNESS[1]

Taking care of your health is important. As a Dalhousie student, you have access to a wide range of resources to support your health and wellbeing. Students looking to access physical or mental health & wellness services at Dalhousie can go to the Student Health & Wellness Centre in the LeMarchant Building. The team includes: registered nurses, doctors, counsellors and a social worker. Visit **dal.ca/studenthealth** to learn more and book an appointment today.

Students also have access to a variety of online mental health resources, including telephone/texting counselling and workshops/training programs. Learn more and access these resources at d**al.ca/mentalhealth**.

[1] Source: Speak Up! © 2005 Southern Poverty Law Center. First Printing. This publication was produced by Teaching Tolerance, a project of the Southern Poverty Law Center. Full "Speak Up" document found at: http://www.dal.ca/dept/dalrespect.html. Revised by Susan Holmes from a document provided April 2015 by Lyndsay Anderson, Manager, Student Dispute Resolution, Dalhousie University, 902.494.4140, lyndsay.anderson@dal.ca www.dal.ca/think.

CULTURE OF RESPECT[2]

Every person has a right to be respected and safe. We believe inclusiveness is fundamental to education and learning. Misogyny and disrespectful behavior in our classrooms, on our campus, on social media, and in our community is unacceptable. We stand for equality. We hold ourselves to a higher standard.

What we all need to do:

1. **Be ready:** promise yourself to not remain silent, know that it will happen again, summon your courage whatever it takes. Practice things to say, open ended is good: "Why did you say that?" or "How did you develop that belief?"
2. **Identify the behaviour:** Use reflective listening, avoid labeling, name-calling or blame. Describe the behaviour, don't label the person: "Kim, what I hear you saying is that …"
3. **Appeal to principles:** this works well if the person is known to you like a friend, sibling, co-worker etc. "Joe, I have always thought of you as a fair-minded person, so it shocks me when I hear you say something like that."
4. **Set limits:** you cannot control another person, but you can control what happens in your space. "Please don't tell racist jokes in my presence anymore" or "This classroom is not a place where I allow homophobia to occur" and then follow through.
5. **Find an ally/be an ally:** seek out like-minded people for support or support others in their challenges. Lead by example and inspire others to do the same.
6. **Be vigilant:** change happens slowly, but be prepared, and keep speaking up. Don't let yourself be silenced.

RESPONSIBLE COMPUTING POLICY

Usage of all computing resources in the Faculty of Computer Science must be within the Dalhousie Acceptable Use Policies (https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/Acceptable%20Use%20Policy%20Feb%202020.pdf) and the Faculty of Computer Science Responsible Computing Policy (https://www.cs.dal.ca/downloads/fcs_policy_local.pdf)

UNIVERSITY STATEMENTS

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate. https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=111&chapterid=6817&loadusercredits=False

Territorial Acknowledgement

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

Dalhousie acknowledges the histories, contributions, and legacies of the African Nova Scotia people and communities who have been here for over 400 years.

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
http://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-

[2] Source: Speak Up! © 2005 Southern Poverty Law Center. First Printing. This publication was produced by Teaching Tolerance, a project of the Southern Poverty Law Center. Full "Speak Up" document found at: http://www.dal.ca/dept/dalrespect.html. Revised by Susan Holmes from a document provided April 2015 by Lyndsay Anderson, Manager, Student Dispute Resolution, Dalhousie University, 902.494.4140, lyndsay.anderson@dal.ca www.dal.ca/think.

person) that result in barriers to your inclusion please contact: https://www.dal.ca/campus_life/academic-support/accessibility.html for all courses offered by Dalhousie with the exception of Truro.

Conduct in the Classroom — Culture of Respect
Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion — Culture of Respect
Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). (read more: http://www.dal.ca/cultureofrespect.html)

Student Code of Conduct
Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. (read more: https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/Code%20of%20Student%20Conduct%20rev%20Sept%202021.pdf)

Fair Dealing Policy
The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. (read more: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html)

Originality Checking Software
The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work, and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. (read more: https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/OriginalitySoftwarePolicy.pdf)

All submitted code may be passed through a plagiarism detection software, such as the plagiarism detector embedded in Codio, the Moss (https://theory.stanford.edu/~aiken/moss/) Software Similarity Detection System, or similar systems. If a student does not wish to have their assignments passed through plagiarism detection software, they should contact the instructor for an alternative. Please note, that code not passed through plagiarism detection software will necessarily receive closer scrutiny. https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/OriginalitySoftwarePolicy.pdf

Student Use of Course Materials
These course materials are designed for use as part of the CSCI courses at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading material to a commercial third party website) may lead to a violation of Copyright law.

Learning and Support Resources
Please see https://www.dal.ca/campus_life/academic-support.html

- Dalhousie University Library http://libraries.dal.ca/