

CS 695 / SWE 699: Software Engineering for Real-Time Embedded Systems

Fall 2022

Contact Information

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Day/Time TBD
(But feel free to pop in
anytime my door is open!)

Course Overview

This is a graduate course in Real-Time Embedded Software Engineering. This course is cross-listed between CS 695 and SWE 699. This course will count as an “advanced” course for the MS CS degree or as a 600-level Software Engineering elective for the MS SWE degree.

The course will predominantly be taught from a hands-on, project-based approach. There will also be a research and presentation component but these will also be focused on practical applications vs. theory.

Learning Objectives

Upon completion of this course, students should have:

- An understanding of the scope and type of real-time and embedded (RTE) software-intensive systems
- A general understanding of the overall software development processes for RTE systems, focusing on an agile framework
- Specific, hands-on knowledge of programming and testing RTE software
- An understanding of real-time operating systems
- Advanced and emerging topics will be explored as time permits. Some examples include the use of RTE systems supporting the Internet of Things or deploying machine learning algorithms on edge devices.

Prerequisites

This course assumes no prior knowledge of real-time or embedded systems. Knowledge of basic programming skills and data structures will be assumed. We will mostly use the C programming language but no prior experience with C is required.

Students should also have basic knowledge of computer systems/organization (e.g. CS 367, CS 465, or CS 531)

Course Materials

Required Text: Oshana, Robert, and Mark Kraeling. *Software Engineering for Embedded Systems: Methods, Practical Techniques, and Applications*. Saint Louis: Elsevier Science & Technology, 2019. (ISBN: 0128094486). [GMU Library Link](#)

Recommended Text: Kernighan, Brian W., and Dennis M. Ritchie. *The C Programming Language*. 2nd ed. Englewood Cliffs, N.J: Prentice Hall, 1988. (ISBN : 0131103628) [GMU Library Link](#)

Required Hardware: TBD. We will either use the NXP Freedom Development Board referenced by the Oshana text or another single-board computer based on either the ARM or ATmega architecture. This will depend on what is available for the best cost and supported features given the current chip shortage.

Grading Policy

Class participation	10%
Projects / Programming Assignments	50%
Presentation / Discussion	20%
Final Exam	20%

Class Participation	I strive for highly interactive classes. Please don't be shy about asking questions or volunteering ideas.
Projects / Programming Assignments	We will have a series of programming assignments designed to give you experience with embedded systems development as well as real-time, concurrent programming. These can be completed individually or in groups of 2 – the choice will be left to the student.
Presentation / Discussion	To broaden our understanding of modern RTE systems, you will research a practical application of RTE software and present to the class with a facilitated discussion. This can also be done individually or in pairs.
Final Exam	Comprehensive final exam. Note that I strive to make exams based on practical knowledge rather than simple memorization.

Email policy:

You must use your Mason email account for all email correspondence having anything to do with your work at Mason. Federal laws protecting your privacy rights require that we only communicate student information directly to students –and use of the university email system is our only way to validate your identity. You may forward your campus email elsewhere, but we can respond only to a Mason email account.

Honor Code

You are expected to abide by the [University's honor code](#) and the [CS Department's Honor Code and Academic Integrity Policies](#) during the semester. This policy is rigorously enforced. All class-related assignments are considered individual efforts unless explicitly expressed otherwise (in writing). Review the university honor code and present any questions regarding the policies to instructor. Cheating on any assignment will be prosecuted and result in a notification of the Honor Committee as outlined in the GMU Honor Code.

The material provided in this course is proprietary. Uploading this material anywhere without the express permission of the instructor is strictly prohibited and a violation of the GMU Honor Code.

Disability Accommodations

Students with a learning disability or other condition (documented with [GMU Office of Disability Services](#)) that may impact academic performance should speak with me ASAP to discuss accommodations.

Safe Return to Campus

All students taking courses with a face-to-face component are required to follow the university's public health and safety precautions and procedures outlined on the university [Safe Return to Campus webpage](#). Similarly, all students in face-to-face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, or Red email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

Students are required to follow Mason's current policy about facemask-wearing. As of August 11, 2021, all community members are required to wear a facemask in all indoor settings, including classrooms. An appropriate facemask must cover your nose and mouth at all times in our classroom. If this policy changes, you will be informed; however, students who prefer to wear masks either temporarily or consistently will always be welcome in the classroom.

Campus Closure or Emergency Class Cancellation / Adjustment Policy

If the campus closes, or if a class meeting needs to be canceled or adjusted due to weather or other concern, students should check Blackboard [or other instruction as appropriate] for updates on how to continue learning and for information about any changes to events or assignments.