

# Special Topics: Software for Robotics Today

## CSC 591-024/CSC 791-024

**Instructor:** Dr. John-Paul Ore

**Prerequisites:**

Formal: A software engineering course at the undergraduate or graduate level (equivalent to CSC 510); or permission from the instructor. (ECE 517, 555, 516, 755, or 756 would likely qualify for the 'permission from the instructor')

Informal: Mathematical maturity; comfort reading and writing journal articles; other helpful courses include CSC 333 Automata, Grammars, and Computability, CSC 512 Compiler Construction, or CSC 707 Automata, Languages and Computability Theory.

**Objective or Description:**

Advances in software-enabled robotics are unlocking disruptive capabilities in diverse areas, including transportation, space exploration, domestic assistants, agriculture, and medical robots. This course explores fundamental algorithms and AI-enabled capabilities for robots operating in real-world environments. The focus of the course will be on ways to make software-enabled robotics more reliable through automated testing and analysis. Topics covered in this class include robotic software architecture, motion planning, testing, state estimation, deep learning, AI, manipulation, multi-robot systems, and flying robots. We will explore these topics through the critical analysis of classic and contemporary articles in the fields of robotics and software engineering. By examining algorithms and systems used in the real world, we will determine what it takes to go from theory to implementation. In this class, students will present, discuss, and write analyses of current software engineering and robotics research. Further, students will work in groups on a semester-long project to explore areas of interest in software engineering and robotics. The goal of this course is for students to gain an understanding of the challenges of the current state of the art in software-enabled robotics and to improve problem-solving and critical analysis skills.

**Topics Covered:**

- robotic software architecture
- motion planning
- testing
- state estimation
- deep learning
- AI
- manipulation
- multi-robot systems
- flying robots

Depending on student interest, we will adjust the syllabus to cover areas in more or less detail. If you are particularly interested in covering a topic, please let me know.

**Textbook:**

No textbook, readings will be available as links to online journals.