



EEL 5669

Autonomous Systems and Controls

Section: RVC

Internet/Fully Online

Spring Term 2026

Course Time Zone: Eastern Time (ET). Course due dates and times are according to this time zone.

Professor Information

Ou Bai, Ph.D.

Roles: Primary Instructor

Email: obai@fiu.edu

Response Time: Within 48 hours

Phone: (305) 348-3704

Office Hours: By appointment with a Zoom meeting. Please send an email to the instructor to make an appointment. Please include your name, preferred time (give three if possible), how long is needed, what to discuss, and other necessary information.

Office Location: 10555 W. Flagler Street, Room EC3954

Website: hcps.fiu.edu

Department or Academic Unit: Department of Electrical and Computer Engineering

Additional Notes

C/C++ and/or Java Experience is required; contact the instructor if you don't have any programming experience.

Course Prerequisites

Course prerequisites, if any, are listed below.

Course Description

This course provides a comprehensive introduction to the fundamental components of autonomous systems. In particular, the course will expose the students to the concept of autonomous systems from the perspective of autonomous mobile robotic systems. Topics include locomotion, sensors and actuators, kinematics, robotic vision, localization and mapping, and motion planning.

Textbook and Course Materials

INTRODUCTION TO AUTONOMOUS MOBILE ROBOT

Subtitle: Second edition

Required/Recommended: Recommended

Authors: Roland Siegwart, Illah Reza Nourbakhsh and Davide Scaramuzza

Publisher: MIT Press

Publication Date: 2011

Copyright Date: 2011

ISBN 10: 0262015358

ISBN 13: 9780262015356

Chapters/Pages: 453 pages

Readings, Materials, and Open Educational Resources (OER)

This course will use a mobile robot simulator Coppelia Sim for two projects. A free Education (Edu) version can be downloaded from

<https://www.coppeliarobotics.com/downloads>.

Student Learning Outcomes/Objectives

- Explain the core principles of locomotion, perception, localization, and motion planning in autonomous systems.
- Apply mathematical models and control algorithms for wheeled and legged robots.

- Analyze sensory data (vision, LiDAR, sonar) for environmental perception and feature extraction.
- Design and implement robotic behaviors using CoppeliaSim and Lua scripting.
- Evaluate SLAM and planning algorithms for autonomous navigation tasks.
- Integrate perception, control, and planning modules into a cohesive autonomous system.

Expectations of this Course

This is an online course, which means most (if not all) of the course work will be conducted online. Expectations for performance in an online course are the same as a traditional course. In fact, online courses require a degree of self-motivation, self-discipline, and technology skills which can make these courses more demanding for some students.

Students are expected to:

- **review the getting started** page located in the course modules;
- **introduce yourself to the class** during the first week by posting a self-introduction in the appropriate discussion;
- **take the practice quiz** to ensure that your computer is compatible with the learning management system, Canvas;
- **interact** online with instructor and peers;
- **review** and follow the course calendar and weekly outlines;
- **log in** to the course **3 times** per week;

- **respond** to discussions by the due date specified. **No late work will be accepted;**
- **respond** to **emails** within **2 days**;
- **submit** assignments by the corresponding deadline.

The instructor will:

- log in to the course frequently;
- respond to **emails** within **48 hours**;
- grade assignments and/or provide feedback within **X days** of the assignment deadline.

Assignments & Assessments

University's Code of Academic Integrity

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct that demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.

More information can be found at http://academic.fiu.edu/academic_misconduct.html

Department Regulations Concerning Incomplete Grades

To qualify for an Incomplete, a student:

- Must contact (e.g., by phone, email, etc.) the instructor or secretary before or during the missed portion of the class.

- Must pass the course before the part of the course that is not completed
- Must make up the incomplete work through the instructor of the course
- Must see the instructor. All missed work must be finished before the last two weeks of the following term.

University policies on sexual harassment, religious holidays, and information on services for students with disabilities

- Please visit the following websites: <http://academic.fiu.edu/> and <http://drc.fiu.edu>.

Course Policies:

- **Academic Misconduct:** For work submitted, it is expected that each student will submit their original work. Any evidence of duplication, cheating, or plagiarism will result in at least a failing grade for the course.
- **Deadlines:** Home and project assignments are due on the date specified. Students should check Canvas for the due dates for each assignment. Assignments submitted late (within 1 week) will receive half credit.
- **Assistance in Learning:** Students are encouraged to ask questions and discuss course topics with the instructor and with each other. To get assistance from the instructor, students can make an appointment via email.
- **Any work submitted should be signified as the students' work and that no unauthorized help was obtained.**
- **DO NOT** send assignments by email.
- The instructor reserves the right to change course materials or dates as necessary.

AI Use Policies:

Artificial intelligence (AI) tools, such as ChatGPT, Claude, and Perplexity, as well as other generative platforms, can be valuable resources when used appropriately. To support student learning while maintaining academic integrity, the following AI policies apply to this course:

Permitted Use for Learning and Preparation:

- Students are encouraged to use AI tools as learning aids when preparing for assignments or exams. This includes using AI to clarify concepts, work through textbook problems, and review the material.
- Use of AI in this context should supplement, but not replace, your own efforts to understand the material.

Prohibited Use of AI on Course Assessments:

- The use of AI tools is strictly prohibited during any graded assessments, including exams and home assignments, unless explicitly stated otherwise.
- Violations will be treated as academic misconduct and subject to university disciplinary procedures.

Assignment-Specific Use:

- AI tools may only be used for assignments when explicitly permitted. Any such assignments will include specific guidance on how AI may or may not be used.
- When AI use is permitted, students must clearly disclose how and where AI tools were used (e.g., “ChatGPT was used to generate initial outlines” or “AI was used to check grammar”).

Responsibility and Academic Integrity:

- Students remain fully responsible for the accuracy and integrity of all submitted work, regardless of AI involvement.

- Misuse of AI undermines the learning process and may result in academic penalties.

If you are uncertain whether a specific use of AI is permitted, please contact the instructor for clarification before using it.

Assessment Policy:

To mitigate any issues with your computer and online assessments, you must take the Home Assignments and Exams from a computer you will be using to take your graded assignments and exams. Assessments in this course are not compatible with mobile devices and should not be taken through a mobile phone or a tablet.

Exams:

- There are two (2) exams in this course
- Check the Canvas schedule for dates
- All exams are closed books and closed notes
- All exams are individual work
- Make sure to complete the assigned home assignments to do well in the exam
- Review notes and practice questions are provided for each exam; Check the Modules in the Canvas
- Each exam will extract multiple-choice questions (MCQs) from the same MCQ bank used for practice questions
- You will have 75 minutes to complete 40 multiple-choice questions
- Cheating is considered a serious offense. Students who are caught will receive the appropriate consequences.

Home Assignments:

- There are twelve (12) home assignments (all MCQs) in this course for learning enhancement, as well as review of the course materials.

- Check the Canvas schedule for dates.
- Home assignments are open books and notes
- Home assignments are individual work
- Each home assignment has 15 MCQs, and there is no time limit to complete the assignments
- Students are encouraged to make multiple attempts for each assignment; each attempt might have a different set of MCQs
- Once an answer is chosen, the correct response is given

Projects:

- There are two (2) projects in this course
- Check the Canvas schedule for dates
- The project instructions are provided in Canvas Modules
- Submit your work (*.ttx file and report) using the submission form provided in each assignment
- Projects are grouped; each group has no more than three students

Grading

Course Grades Distribution Table

| Course Requirements | Number of Items | Points for Each | Total Points Available | Weight |
|----------------------------|------------------------|------------------------|-------------------------------|---------------|
| Home Assignments | 12 | 15 | 180 | 20% |
| Total | — | — | — | 100% |

| Course Requirements | Number of Items | Points for Each | Total Points Available | Weight |
|----------------------------|------------------------|------------------------|-------------------------------|---------------|
| Projects | 2 | 100 | 200 | 40% |
| Midterm Exam | 1 | 100 | 100 | 20% |
| Final Exam | 1 | 100 | 100 | 20% |
| Total | — | — | — | 100% |

Letter Grade Distribution Table

| Letter Grade | Sample Range % |
|---------------------|-----------------------|
| A | 95 to 100 |
| A- | 90 to 94.99 |
| B+ | 87 to 89.99 |
| B | 83 to 86.99 |
| B- | 80 to 82.99 |
| C+ | 77 to 79.99 |
| C | 70 to 76.99 |
| D | 60 to 69.99 |
| F | 0 to 59.99 |

Schedule of Topics

This is a tentative schedule. Please refer to the updated schedule including assignment due dates in the Module.

| Week | Topics and Tasks |
|-------------|-------------------------|
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|-------------|--|
| 1 01/05 | Course Introduction Course Syllabus and Schedule Introduction and Motivation (P.1~P.30) Home Assignment (1) |
| 2 01/12 | Locomotion Concepts Introduction to Legged Robotics (P.1~P.16) Fundamentals of Locomotion in Legged Robotics (P.17~P.38) Home Assignment (2) |
| 3 01/19 | Mobile Robots Kinematics Introduction to Wheeled Locomotion (P.1~P.20) Mobile Robot Kinematics (P.21~P.33) Wheeled Mobile Robot Motion Control (P.34~P.40) Home Assignment (3) |
| 4 01/26 | Project Preparation & Project I Introduction to Coppelia Robotic Simulation Platform and Lua API (P.1~P.24) Line Tracking Algorithms and Code Analysis (P.1~P.11) EEL5669_Project_I_Assignment_Instruction Project I Assignment: Line Tracking with Obstacles |
| 5 02/02 | Perception I – Sensors Encoder, Laser Range Finder, Time-of-Flight, Sonar (P.1~P.21) Home Assignment (4) Project I: Line Tracking with Obstacles (DUE) |
| 6 02/09 | Perception II – Fundamentals of Computer Vision (I) Introduction of Computer Vision (P.1~P.15) Camera Image Formation (P.16~P.29) Perspective Effect (P.30~P.33) Home Assignment (5) |
| 7 02/16 | Perception II – Fundamentals of Computer Vision (II) Perspective Projection (P.34~P.40) Camera Calibration (P.41~P.45) Stereo Vision (Optional, P.46~P.72) Structure From Motion (Optional, P.73~P.78) Home Assignment (6) |
| 8 02/23 | Midterm Exam Midterm Review Notes |
| 9 03/02 | Perception III: Fundamentals of Image Processing (I) Image Filtering (P.1~P.28) Edges and Points (P.29~P.52) Home Assignment (7) |
| 10 03/09 | Perception III: Fundamentals of Image Processing (II) Corner and Point Feature Detection (P.53~P.71) SIFT Features (P.72~P.90) Home Assignment (8) |

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|-------------|---|
| 11 03/16 | Project II EEL5669_Project_II_Assignment_Instruction Project II Assignment: Broken Line Tracking |
| 12 03/23 | Perception IV: Place Recognition & Line Fitting Object and Place Recognition (P.1~P.37) Uncertainty Representation and Split-and-Merge Algorithm for Line Extraction (P.38~P.58) Line Extraction Algorithms (Optional, P.59~P.84) Home Assignment (9) Project II: Broken Line Tracking (DUE) |
| 13 03/30 | Localization Introduction to Localization (P.1~P.11) Map-Based Localization (P.12~P.28) Home Assignment (10) |
| 14 04/06 | SLAM The SLAM Problem (P.1~P.28) SLAM Formulation (P. 29~P.44) Other Approaches to SLAM (Optional, P.45~P.63) Home Assignment (11) |
| 15 04/13 | Planning Introduction to Path Planning (P.1 ~P.32) Graph Search Methods (Optional, P.33~P.86) Collision Avoidance (P.87~P.101) Home Assignment (12) |
| 16 04/20 | Final Exam Final Exam Notes |

Course Communication

Communication in this course will take place via **the Canvas Inbox**. Check out the [Canvas Conversations Tutorial](#) or [Canvas Guide](#) to learn how to communicate with your instructor and peers using Announcements, Discussions, and the Inbox.

I will respond to all correspondence within **3 days**.

Policies & Resources

Before starting this course, please review the Policies & Resources Page in Canvas, which includes comprehensive information on various University and Course Level Policies, such as:

- University Policies
- Accessibility and Accommodations
- Online Etiquette
- Technical Requirements and Skills
- Computer & Digital Literacy Skills
- Course Technology Accessibility Statements and Privacy Policies
- Academic Integrity
- Copyright Statement
- Nondiscrimination Statement
- Panthers Care & Counseling and Psychological Services (CAPS)
- Fair Use Policy

Nondiscrimination Statement

The **Office of Civil Rights Compliance and Accessibility** (CRCA) is responsible for ensuring that FIU maintains a workplace and learning environment free from discrimination, where current and prospective faculty, staff, and students are treated equitably. If any student, employee, or applicant has a sincere and reasonable belief that they have been discriminated against or harassed based on age, color, disability, marital status, ethnic or national origin, race, religion, retaliation, sex, or

any other protected category, they can report their concerns to the CRCA team through report.fiu.edu.

