

ENGR 4421: Robotics II (CRN33091)

Spring, 2024

Class / Lab

Time: Tuesday & Thursday, 10:50 AM–1:30 PM

Location: Lewis Science Center Annex (LSCA) 105

Course Materials: https://linzhanguca.github.io/robotics_2-2024

Instructor

Name: Lin Zhang

Office: LSCA 105 *Look for me in LSC 110 or LSC 013 if not in lab.*

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Overview

Course Description

Robotics II is an engineering course that introduces a variety of advanced theories and technologies in robotics to junior/senior level undergraduate students. The goal of this course is to introduce key concepts and skills involved in building autonomous mobile robots. The Robot Operating System (ROS) will be introduced to students to help them manage more complicated robotic systems with all kinds of sensors and actuators. Individual and teamed tasks will be assigned to the students to help them master the knowledge.

Prerequisites

Minimum grade of C in ENGR 3421: Robotics I is pre-required.

Textbooks

The course will heavily rely on the official online [ROS2 Documentation](#).

Supplies

This course will provide most the supplies for free, including laptop computers, robot assembly parts, micro-controllers, sensors, crafting tools, measuring tools, programming software etc. Students are welcome to ask the instructor to purchase reasonable supplies if needed.

Students can take their robots and computers out of the classroom. Tools, computer peripherals (e.g. monitors, keyboards and mice) can be taken out only if asked the instructor for permission.

Classroom Policy

Wear safety goggles all the time! The instructor and the students are expected to appear in the classroom/lab in every class. If any student cannot show up on time, he/she needs to contact the instructor in advance. The instructor will notify the students with any changes of a class in advance. Food and drinks are allowed in the designated area **ONLY**.

Grading

A's are 86-100%, B's are 70-85%, C's are 55-69%, D's are 50-54%, F's are 0-49%. The final grade will be determined by following criteria.

Component	Percentage	Note
Attendance	1%	Show up in every class
Assignments	19%	Complete coding task
Project 1	20%	Coding & documentation
Project 2	25%	Coding & documentation
Final Project	35%	Coding, documentation& presentation
Total	100%	

Other Policies

The policies and procedures detailed in the UCA 2023-2024 Student handbook are also part of this syllabus. Please refer to the relevant policies as your guidance.

<https://uca.edu/student/files/2023/08/STUDENT-HANDBOOK-2023-2024.pdf>

If a student discloses an act of sexual harassment, discrimination, assault, or other sexual misconduct to a faculty member (as it relates to “student-on-student” or “employee-on-student”), the faculty member is encouraged to report the act to the Title IX coordinator, deputy coordinator, or employee with the authority to institute corrective measures on behalf of the University. An investigation of a formal complaint of Title IX Sexual Harassment will only be initiated when the Complainant (individual who suffers actual harm from the violation of the Title IX Sexual Harassment Policy) or the Title IX Coordinator signs a complaint. For further information, please visit: <https://uca.edu/titleix/>. *Disclosure of sexual misconduct by a third party who is not a student and/or employee is also encouraged if the misconduct occurs when the third party is a participant in a university-sponsored program, event, or activity.

Academic Integrity

The University of Central Arkansas affirms its commitment to academic integrity and expects all members of the university community to accept shared responsibility for maintaining academic integrity. Students in this course are subject to the provisions of the university's Academic Integrity Policy, approved by the Board of Trustees as Board Policy No. 709 on February 10, 2010, and published in the Student Handbook. Penalties for academic misconduct in this course may include a failing grade on an assignment, a failing grade in the course, or any other course-related sanction the instructor determines to be appropriate. Continued enrollment in this course affirms a student's acceptance of this university policy.

Building Emergency Plan

An Emergency Procedures Summary (EPS) for the building in which this class is held will be discussed during the first week of this course. EPS and Building Emergency Plan (BEP) documents for most buildings on campus are available at <https://uca.edu/go/bep-library>. Every student should be familiar with emergency procedures for any campus building in which he/she spends time for classes or other purposes.

Disabilities

The University of Central Arkansas adheres to the requirements of the Americans with Disabilities Act. If you need an accommodation under this Act due to a disability, please contact the Office of Accessibility Resources and Services (OARS), 450-3613.

Course Evaluation

The Student Course Experience Survey is a crucial element in helping faculty achieve excellence in the classroom and the institution in demonstrating that students are gaining knowledge. Students may complete surveys for courses they are taking starting on Monday, April 8th, through the Sunday, May 5th after finals week. Students can log in to myUCA and complete course evaluation within [Feedback Hub](#).

Course Contents

Please refer to the following for a tentative course plan. Due to the progress of the course, the actual contents will be subject to changes.

- **Students need to work on assignments individually.**
- **Students can work on projects in teams.**
- **All assignments and projects due at 1:30 PM on Thursdays.**

Module 1 - Setup the Robot

Students will use the knowledge and skills learned from Robotics 1 to build new differential drive mobile robots. Robot Operating System (ROS) Command-Line Interface will be introduced.

- **Assignment 1 (Individual):** Create a ROS package. **Due date:** Thursday, 02/01/2024.
- **Assignment 2 (Individual):** Keyboard controller. **Due date:** Thursday, 02/22/2024.
- **Project 1 (Team):** ROS managed prototype. **Due date:** Thursday, 02/29/2024.

Module 2 - Model the Robot

Students will learn how to Simulate a robot using URDF files and Gazebo simulator. Sensors and

- **Assignment 3 (Individual):** Model a robot. **Due date:** Thursday, 03/07/2024.
- **Assignment 4 (Individual):** Simulate a robot. **Due date:** Thursday, 03/14/2024.
- **Project 2 (Team):** Simulated prototype. **Due date:** Thursday, 04/04/2024.

Module 4 - Navigate the Robot

Students will integrate LiDAR and/or IMU in their robotic projects. Students will be introduced to *Nav2* and *slam_toolbox* packages to build maps and navigate the robot in the maps.

- **Final Project (Team):** Navigate Lewis Science Center. **Due date:** Thursday, 05/02/2024.