Intro to Autonomous Robotics

CS 460-001 | Fall 2020 | 3 Credit Hours
Lecture
Chris Crawford

Contact Information

UA Campus Directory:
- Chris Crawford (https://www.ua.edu/directory/?i=cscrawford#listing)

Prerequisites

UA Course Catalog Prerequisites:
CS 300, CS 301 and ECE 383

- Graduate status or CS426, CS470 or Permission from Instructor

- Strong knowledge of Linux

Course Description

Course Description and Credit Hours
Issues involved with the implementation of robot control software including motion, kinematics, simulation testing, sensor incorporation and unmodeled factors.

In this course, we will explore topics related to implementing intelligent robotic systems.

Required Texts

Required Texts from UA Supply Store:
- NONE / NO TEXT REQUIRED **(Required)**

Student Learning Outcomes

- The students will be able to:

   - Implement autonomous navigation control software in simulation.

   - Understand the issues involved in implementing robot control software including motion kinematics and dynamics, simulation testing, and sensor integration.

Other Course Materials

- Computer to run ROS and player/stage for homework assignments

- Students will need to buy a 32GB micro SD card and other accessories.

- Laptop capable of running https://www.theconstructsim.com/

- Additional software list will be made available if necessary.

Outline of Topics

- Kinematics - differential driv

- PID

- Sensors and sensor models

- Architectures and frameworks

- Obstacle avoidance

- Robot vision

- Representation and Planning

- Human-Robot Interaction

Exams and Assignments

* **Homework** - Students will complete homework assignments consisting of behavior implementation on robots and in simulation.

* **Midterm Exam** – Kinematics for differential drive, sensors, PID controllers, ROS

* **Quizzes**

* **Class Project**

The final project is an individual or group project designed to allow each student to explore a specific area of interest. Projects can either simulate robots or implement behaviors directly on the turtlebot robots. Group projects should be larger in scale than individual projects.

The project will be completed in three parts:

– Project proposal (15%): Present relevant previous literature and an approach to designing an autonomous mobile robot. Introduction, related work, and algorithm approach.

– Project presentation (10%): Oral 10-15 minutes presentation (video recording).

– Final project Code Virtual Demo/Paper (15%):

Grading Policy

10% Midterm exam

10% Quizzes

40% Final Project

40%-Homework

Policy on Missed Exams and Coursework

All assignments are to be turned in at the beginning of class in which they are due. Late assignments are not accepted. To that end, it is strongly suggested that all assignments are started early. If completing an assignment on time is a problem, please talk to me **before** the assignment is due.

Attendance Policy

Regular attendance is expected. If you miss a class, it is your responsibility to make up missed work.

Notification of Changes

The instructor will make every effort to follow the guidelines of this syllabus as listed; however, the instructor reserves the right to amend this document as the need arises. In such instances, the instructor will notify students in class and/or via email and will endeavor to provide reasonable time for students to adjust to any changes.

Statement on Academic Misconduct

Students are expected to be familiar with and adhere to the official Academic Misconduct Policy (https://catalog.ua.edu/undergraduate/about/academic-regulations/student-expectations/academic-misconduct-policy/) provided in the Online Catalog.

Statement On Disability Accommodations

Contact the Office of Disability Services (ODS) (https://catalog.ua.edu/undergraduate/about/support-programs/disability-services/) as detailed in the Online Catalog.

Severe Weather Protocol

Please see the latest Severe Weather Guidelines (https://ready.ua.edu/severe-weather-guidelines/) in the Online Catalog.

Pregnant Student Accommodations

Title IX protects against discrimination related to pregnancy or parental status. If you are pregnant and will need accommodations for this class, please review the University's FAQs on the UAct website (https://www.ua.edu/campuslife/uact/information/pregnancy) .

Religious Observances

Under the Guidelines for Religious Holiday Observances, students should notify the instructor in writing or via email during the first two weeks of the semester of their intention to be absent from class for religious observance. The instructor will work to provide reasonable opportunity to complete academic responsibilities as long as that does not interfere with the academic integrity of the course. See full guidelines at Religious Holiday Observances Guidelines (https://provost.ua.edu/oaa-guidelines-for-religious-holidays-observance) .

UAct Statement

The University of Alabama is committed to an ethical, inclusive community defined by respect and civility. The UAct website (www.ua.edu/uact (https://www.ua.edu/uact)) provides extensive information on how to report or obtain assistance with a variety of issues, including issues related to dating violence, domestic violence, stalking, sexual assault, sexual violence or other Title IX violations, illegal discrimination, harassment, hate or bias incidents, child abuse or neglect, hazing, threat assessment, retaliation, and ethical violations or fraud.

Statement on COVID-19

All University faculty, staff, and students are expected to maintain a commitment to the health and safety of our campus community. Due to the current COVID-19 pandemic, specific health and safety standards are in place to minimize exposure and community spread on campus. In the interest of your health and safety and that of all UA students, faculty and staff, the University reserves the right to change the mode of instruction or schedule of instruction at any time, based upon prevailing public health and other guidance. While the method of delivery may change, educational instruction and opportunities will continue. As such, the University will not provide a refund of tuition, in whole or in-part, based on any such changes. Detailed information on changes in format or schedule can be found at studentaccounts.ua.edu (https://studentaccounts.ua.edu) and financialaid.ua.edu (https://financialaid.ua.edu/) .

All students must be familiar with and abide by the requirements outlined in the UA Return Plan | UA System Comprehensive Health and Safety Plan. Students must (1) wear a mask or face covering at all times while participating in face-to-face class; (2) adhere to social distancing standards; and (3) comply with all other health and safety restrictions. If a student refuses to comply with the requirements, the student will be asked to leave the class and reported for a conduct violation. Unless a student has an exemption from the requirement to wear a face covering, (more information can be found at ods.ua.edu/covid-19-

disability/ (http://ods.ua.edu/covid-19-disability)), the student will be reported to Student Life for further disciplinary action. More information on these requirements and UA Healthcheck system and screening can be found at healthinfo.ua.edu/returnplan (https://healthinfo.ua.edu/returnplan) . You are expected to visit the site and comply with all noted requirements related to in-person class attendance.