Special topics course proposal for School of Engineering and Computing Christopher Newport University

Fundamentals of Unoccupied Aerial Vehicles

Course Number: CPSC 495/595
Semester: Spring 2026
Instructor: Dr. Abhishek Phadke
Credit Hours: 3

Suggested class cap: **24 students**

Course Overview

This course introduces students to fundamentals of **Unoccupied Aerial Vehicles (UAV)**. Students will explore drone dynamics, sensor integration, mission design, and autonomy principles through both simulation and (optional) EDU drone kits. By semester's end, students will gain foundational skills in flight control, coding, and robotics system design that bridge computer science, engineering, and data analytics.

Course Vision/Learning outcomes

1. The course aims to make robotics and aerial systems accessible to undergraduates of all technical backgrounds through experiential, project-based learning.
2. Students will:
   Learn to code and simulate UAVs safely using free educational tools.
   Understand the interplay of hardware, software, and control logic.
   Develop transferable problem-solving skills relevant to autonomous systems, data communication, and AI-enabled robotics.
3. Engage in a final project demonstrating UAV behavior and modeling.

Tentative topic coverage

Week number	Topic	Supporting activity
Week 1	Overview of UAV domain Introduction to UAV sensors	In-class discussion
Week 2	Introduction to the CoppeliaSim simulation platform • Installation • Scripting • Platform capabilities • Drone sensor processing	In-class lab and supporting assignment
Week 3	Introduction to Robolink hardware platform • Assembly • Control • Scripting • Data processing	In-class lab
Week 4	**Midterm exam 1**	In-person, group based, hands on programming-based exam. [Drone race/Obstacle course]
Week 5	Principles of Drone GNC [Guidance Navigation Control]	Lecture + supporting assignment
Week 6	CoppeliaSim modeling and simulation • Drone simulation • Scripting • Platform capabilities	Lecture + supporting lab/assignment
Week 7	Final project details released: A **group project** on the following tracks can be chosen -Simulation and modeling track -UAV data processing track - Independent topic proposal [Based on instructor decision]	Begin preparing project and presentation
Week 8	CoppeliaSim modeling and simulation • Scene creation • Research application • Demonstration	Lecture + supporting lab/assignment
Week 9	Applications for UAV UAV swarms [Challenges, applications]	Lecture + supporting assignment
Week 10	**Midterm exam 2**	Multiple choice + written exam
Week 11	Broad domain robotics: Assembling Robolink Zumi	Hands on, in class lab/activity

	AI based coding for Zumi	
Week 12	Drone research activity week 1 [Project progress presentation + research activity]	
Week 13	Drone research activity week 2 [Project progress presentation + research activity]	
Week 14	Final project presentations/demos	
Week 15	**Final exam**	Comprehensive final exam

Grade distribution

- Midterm exam 1: 12%
- Midterm exam 2: 12%
- Final exam: 14%
- Final project: 12%
- Final project presentation: 3%
- In-class quiz: 15%
- Assignments: 22%
- In-class labs/activities: 10%

595 syllabi

- 595 students will do individual group projects instead of group projects
- They will also do an additional research activity.