Warren County Community College

UAS 211 Introduction to Robots & Programming

Course Master Syllabus

Course Information

Catalog Description: This course introduces students to the fundamentals of robotics and robotic systems. The course gives students an overview of various robotic system architectures and navigates them through the electro-mechanical fundamentals of robotic systems, including chassis, motors, motor drivers, processing, sensor systems and manipulators. Students will outfit an Autonomous Mobile Robot (AMR) and equip it with sensors. They will program the robot using C/C++ to fulfill various navigational objectives autonomously.

Prerequisite(s):

Corequisite(s): UAS 208 – Advanced UAS Systems, Robotic Assembly, & Operational Performance

Credits: 3

Hours: 2 lecture 1 lab

Required Text(s):

Supplemental Materials: Recon Robot Chassis (provided by the instructor)

Instructor Information

Instructor's Name:

Contact Information:

Office Hours:

Program Goals

1. Equip students with comprehensive knowledge of unmanned systems, including their standards, regulations, and operational frameworks, preparing them for FAA Part 107 certification and other regulatory requirements.

2. Develop proficiency in using geographic information systems (GIS) and remote sensing technologies, enabling students to analyze and interpret spatial data for applications in environmental monitoring, urban planning, and emergency response.
3. Foster a strong understanding of safety protocols, risk management strategies, and security measures in unmanned aviation to ensure compliance with industry standards and promote operational excellence.
4. Provide hands-on training in maintaining, repairing, and optimizing unmanned aircraft systems (UAS) to extend operational life and enhance performance in various industry settings.
5. Introduce students to advanced robotics, programming, and cutting-edge technologies, including infrared thermography and digital photography, to expand their expertise in innovative applications of unmanned systems.
6. Equip students with the skills and knowledge to contribute to the development and operation of innovative unmanned aerial transportation systems, addressing future urban and regional mobility challenges.

Class Core Competencies

The following core competencies are embedded in this curriculum:

- Communicate effectively in both speech and writing.
- Apply appropriate mathematical and statistical concepts and operations to interpret data to solve problems.
- Use scientific method of inquiry, through the acquisition of scientific knowledge.
- Use computer systems or other appropriate forms of technology to achieve educational and personal goals.
- Address an information need by locating, evaluating, and effectively using information.

Class Learning Assessment

Student Learning Outcomes	Suggested Means of Assessment
Identify various robotic system architectures.	Hands-on lab exercises and quizzes
Identify and explain various critical robotic components and their relationships or connection to other components.	Hands-on lab exercises and quizzes

Student Learning Outcomes	Suggested Means of Assessment
Connect various components and sub-systems in a robotic platform.	Hands-on lab exercises
Navigate the various sensor systems used for the Autonomous Navigation of Robotic platforms.	Hands-on lab exercises and quizzes
Demonstrate the process of coding robotic microcontrollers using C/C++	Hands-on lab exercises and group project
Demonstrate how robotic microcontrollers accept inputs from sensors and read their values.	Hands-on lab exercises
Demonstrate how robotic microcontrollers interface with various outputs.	Hands-on lab exercises

Grading System

Letter Grade	Percentage Range
A	90 to 100 percent
B Plus (B+)	87 to 89.9 percent
B	80 to 86.9 percent
C Plus (C+)	77 to 79.9 percent
C	70 to 76.9 percent
D	60 to 69.9 percent
F	Below 60 percent

College Information

Disability Services
Disability Services Webpage

Statement and Policy on Cheating, Plagiarism, and Academic Conduct
Academic Conduct Policy (Policy 304) [PDF]

Students are required to perform all the work specified by the instructor and are responsible for the content and integrity of all academic work submitted. A violation of academic integrity will occur if a student: (1) knowingly represents work of others as one's own, (2) uses or obtains unauthorized assistance in any academic work, (3) gives

fraudulent assistance to another student, or (4) furnishes false information or other misuse of college documents.

Unauthorized use of Artificial Intelligence (AI) is prohibited unless the instructor explicitly permits it in the syllabus or assignments. If tools such as ChatGPT are permitted by an instructor to be used for an assignment, they should be used with caution and with proper citation. In all such cases, you may only use the specific tools identified as acceptable and you must adhere to the College's standards for attribution, validation, and transparency.

In cases of suspected violation of academic integrity, the incident is to be reported to the Office of Academics. A student found guilty of violating the rule of academic integrity by the Vice President of Academics will be considered to have failed in personal obligation to the College; such failure will be subject to disciplinary action by the College. Unless otherwise notified, the instructor will allow students who are pending disciplinary action to attend class.

Tutoring and Testing at the Instructional Support Center (ISC)

- Instructional Support Center (ISC) Webpage

WCCC Library Services

- WCCC Library Website

Citation Styles and Formatting

Work submitted for any Warren County Community College course must conform to the required formatting and citation style that are specified by the instructor. The Library and Instructional Support Center can assist students with formatting and citations for assignments and papers.

WCCC Attendance Expectations

The College expects students to attend and participate in all classes. This involves sharing discussions and lectures in class, as well as interacting with other students. Grades are based on the quality of work students complete in meeting the requirements for a particular course, as stated in the course syllabus and catalog description. Attendance, among other factors, may be an additional criterion for assigning grades. Students should realize that they are responsible for all class meetings and that work missed because of absences may affect their grades. Attendance in online classes is determined by the completion of assignments/ tests. Students who have not completed

any assignments or tests will be considered non-attending and receive an NF grade in online classes.

Class Attendance Expectations

Topical Outline

1. Introduction to robotic systems and robot architectures
2. Chassis design, layout and fabrication methodologies
3. Motors, traction and steering
4. Processing and closed-loop control
5. Introduction to coding in C/C++
6. Motor drivers and control theory
7. Power supply and management
8. Wiring, connection mechanisms, connector types and harnesses
9. Robotic sensing
10. Guidance and navigation using sensors
11. Robotic manipulators and servo control
12. Obstacle avoidance using sensors
13. Introduction to Robot Operating System (ROS) and mapping

Grading Methods

Assignment	Points/Percentage

Class Itinerary

Week / Unit	Topic	Readings/Assignments