Miami Dade College

Course Description

ETI4480C | Applied Robotics | 4.00 credits

This is an upper division course designed as an introduction to robotics programming and includes robotic applications for multifunction part manipulation and motion with stepper and servo-motors. Students learn topics related to robotic design including robotic vision, motion planning, sensing and sensors, actuators, navigation systems, mobility, forward and inverse kinematics, and path planning. Laboratory activities provide hands-on application of concepts and theories.

Course Competencies

Competency 1: The student will demonstrate an understanding of robotics and the history of robotics by:

1. Constructing a block diagram of a robotic system
2. Defining what an autonomous robot is and how it differs from command/remote controlled robotics
3. Discussing the design steps followed to develop a robotic system
4. Identifying and discussing the various disciplines involved in the construction of or application of robotics
5. Listing and describing the classification of robots by power-supply control methods (i.e., electrical, pneumatic, and hydraulic) and motion control methods (i.e., limited sequence, point to point, continuous path, etc.)
6. Explaining the basic types of robot controls including drum, air logic, programmable, microcontroller, and microprocessor controllers
7. Discussing the past, present, and future of robotic systems, motion control systems, and artificial intelligence

Competency 2: The student will demonstrate an understanding of the purpose and application of a micro- controller by:

1. Explaining how a micro-controller and other control units are used in robotic and motion control applications
2. Interfacing sensors and motors with a microcontroller
3. Describing the basic instruction set for a microcontroller
4. Using a micro-controller and sensor assembly to build a robot
5. Creating application programs to make the robot perform simple tasks

Competency 3: The student will demonstrate an understanding of input (sensors) and output devices and their functions in a robotic system by:

1. Analyzing the correlation between human sensors and robotic sensors
2. Applying human and animal sensing principles to robotics design
3. Identifying and using discrete sensors (such as proximity sensors, photo sensors, ultrasonic sensors, other vision sensors such as cameras) in a robotics project
4. Identifying and using analog sensors (i.e., thermal, pH, pressure, speed, flow, etc.) in a robotics project
5. Identifying and using discrete devices (i.e., LEDs, solenoids, motors, relay, valves, etc.) in a robotics project
6. Identifying and using analog devices (i.e., heaters, chemical metering, control valves, LCDs, etc.) in a robotics project
7. Describing the differences between AC, DC, stepper, vector AC drivers, and/or servo motors in a robotics project
8. Using AC, DC, stepper, vector AC drivers, and/or servo motors in a robotics project
9. Building a robotic system that uses three or more sensors to perform a given task autonomously

Competency 4: The student will demonstrate an understanding of robot mobility and navigation by:

1. Applying the physical concepts of position, orientation, velocity, and acceleration to the design of a mobile robot
2. Defining and using differential drive and/or skid steering in a robotics project

3. Identifying the various advantages and disadvantages of different types of drive trains (e.g., direct drive, geared drive, etc.)

Competency 5: The student will demonstrate an understanding of programming robotic functions by:

1. Manipulating external system data (barcode, RFID, printer, NFC, etc.)
2. Manipulating logic using timers, counters, logic instructions, etc.
3. Writing an algorithm that interfaces externally using an analog to digital converter
4. Developing feedback loops for automated control
5. Programming a microprocessor/microcontroller to control a robot that performs a given task autonomously
6. Implementing control system software to interface with hardware
7. Interfacing motors to achieve specialized and accurate motion movements

Competency 6: The student will demonstrate an understanding of troubleshooting and maintenance functions of their robotic system by:

1. Determining a probable cause of a problem
2. Performing diagnostic tests on hardware and software systems
3. Interpreting diagnostic results
4. Recommending solutions to resolve the immediate problem and identifying the root cause of a failed component
5. Testing, implementing, and monitoring recommended solutions
6. Documenting all changes and corrections made to the design

Competency 7: The student will demonstrate the ability to deliver presentations and disseminate information by:

1. Identifying a relevant topic (i.e., sensor, microcontroller, drive train design, etc.) and presenting that topic to the class, including at a minimum history, design, application, use, and sources
2. Presenting the final design and prototype of their robotic system

Learning Outcomes

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information