**Basic Course Information:** CS 5220

Course Title: Distributed Intelligence in Robotics

Units: 3 units

CS number: C-2

Component: Lecture

Instructional Mode: Face-to-Face and web-assisted

Grading Basis: Graded only

Repeated Basis: May be taken only once

Cross listed Course:

Dual-listed Course: N/A

Major course/Service course/GE course: Major course

Date Prepared: Apr. 1, 2015

Prepared by: Daisy Tang

# I. Catalog Description

Multi-robot architecture, multi-robot taxonomies, multi-robot communication, and the state-of-the-art research issues in this field, such as swarm intelligence, multi-vehicle collaboration, task allocation, multi-robot or human-robot teaming, and reconfigurable robotics.

**II. Required Coursework and Background**

Pre-requisite(s): CS2560 and CS 3310, or consent of instructor.

# III. Expected Outcomes

On successful completion of this course, students will be able to:

* Recognize challenges of designing software for controlling multiple robots/agents.
* Compare and contrast different multi-robot architectures.
* Gain proficiency in programming robotic team behaviors and communication.
* Learn the current-state-of-the-art in developing multi-robot systems.
* Gain experience in robot simulators.

Outcomes of this course will build student capacity in each of the following areas as defined by programmatic objectives for the computer science major.

P-SLO 3. An ability to build applications, either individually or in a team, that are robust, reliable, and maintainable.

P-SLO 4. A breadth of advanced knowledge and skills in applied areas of computer science.

# IV. Instructional Materials

**Required text**:

None.

**Reference**:

Selected technical papers in recent robotics publications.

# V. Minimum Student Material

Class handouts (research papers)

# VI. Minimum College Facilities

A classroom with a projection system, whiteboard, and a computer lab

# VII. Course Outline

* Introduction to software issues for multi-robot teams
* Taxonomy
* Swarm Intelligence
* Multi-robot communication
* Multi-robot applications: search and rescue, formation, herding)
* Multi-robot cooperation
* Multi-robot coordination
* Task allocation
* Localization and mapping
* UAVs and UGVs
* Human-robot teaming
* Design behavior-based system
* Sensing
* Navigation
* Localization and mapping

# VIII. Instructional Methods

Lecture

Problem-solving/Discussion

In-class exercises

Student presentation and evaluation

Programming projects

# IX. Evaluation of Outcomes

A. Student Assessment

1. Homework/Project assignments

2. Midterm exam

3. Final exam

4. Research paper presentation

B. Meaningful Writing Assignment

* Students shall produce written solutions or proofs or programs to problems that are assigned as homework and/or programming projects and explain their reasoning.
* Short answer essay questions on exams will require students to explain and justify their response in writing.

C. A Matrix of Course Student Learning Outcomes vs Methods of Assessment

If the course is being evaluated for accreditation purposes, approved department accreditation assessment tools will additionally be utilized.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Learning Outcomes | Methods of Assessment | | | | |
| Class Participation | Homework | Programming Projects | Presentation | Exams |
| 1 Recognize challenges of designing software for controlling multiple robots/agents. | X | X | X | X | X |
| 2 Compare and contrast different multi-robot architectures. | X | X | X | X | X |
| 3 Gain proficiency in programming robotic team behaviors and communication. |  |  | X |  | X |
| 4 Learn the current-state-of-the-art in developing multi-robot systems. | X | X | X | X | X |
| 5 Gain experience in robot simulators. |  |  | X |  |  |