COURSE DESCRIPTION

Department and Course Number: CSCI 490

Course Title: Special Topics
(Topic described here is Behavior-Based Robotics.)

Current Catalog Description: Study of topics in computer science according to the interests of the instructor and students.

Total Credits: 3 hours

Coordinator: H. Conrad Cunningham, Chair & Associate Professor of Computer and Information Science. Developer of Behavior-Based Robotics topic is Pamela B. Lawhead, Associate Professor of Computer and Information Science.

Textbook: Ronald C. Arkin. *Behavior-Based Robotics*, MIT Press, 1998. ISBN 0-262-01165-4.

References: http://www.cs.olemiss.edu/~lawhead. This is a collection of journal articles compiled by the instructor.

Course Goals: The behavior-based robotics course explores methods for controlling artificial systems. The goal for the class is two-fold. First we study and understand the idea of behavior-based robotics controllers and second, we apply some of the standard algorithms to the robot that we have built and called SKIP.

Prerequisites by Topic: Consent of instructor. For this topic, senior standing in computer science.

Major Topics Covered in the Course: Time estimations are approximations only.

1. Overview of Robotics (1 week)
2. The core issues of Intelligent Robotics (1 week)
3. Animal Behavior (1 week)
4. Robot Behavior (2 weeks
5. Behavior Based Architectures (2 weeks)
6. Representation Issues for behavioral systems (1 week)
7. Hybrid deliverative/reactive architectures (week)
8. Perceptual basis for behavior-based control (1week)
9. Adaptive Behavior (1week)
10. Social Behavior (1week)
11. Programming SKIP (2weeks)

Laboratory projects: The students are divided into five groups. Each group is responsible for all programming for one of the sensor systems of the robot. The groups include: Vision, GIS, Sonar, Steering and Motor. Each group was required to maintain a web page and a journal about the work done by that group.

The goal for the class was to create a reactive robot, using a subsumptive architecture that could roam about the circle in front of the Lyceum avoiding any obstacles and always moving. (The intelligence level was to be that of a common insect.)

Estimate of ABET/CAC Category Content:

	CORE	ADVANCED		CORE	ADVANCED
Data Structures		1	Computer Organization and Architecture		
Algorithms		1	Concepts of Programming Languages		
Software Design		1			

Oral and Written Communications:

Every student is required to submit at least 0 written reports (not including exams, tests, quizzes, or commented programs) of typically 0 pages and to make 2-3 oral presentations of typically 20 minutes duration. This includes only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.

Social and Ethical Issues:

A brief discussion on the social implications of robots – e.g. we looked at some of the COG videos and discussed models of intelligence and the philosophical implications of this.

Theoretical Content (Foundations):

This course involved the understanding of subsumptive architectures in robotics. Thirty hours of study or a bit more than half of the instructional time was spent on analysis of software designs required to program a reactive robot using subsumption.

Problem Analysis:

Each group had a different problem to solve. Some of the problems were far more sophisticated than others but all involved two levels of analysis. Each group had to overcome some hardware related obstacle or series of obstacles and the related software solutions. More than half of the effort expended by the students was in simply figuring out what needed to be done in light of the tools available.

Solution Design:

The solution design involved two realms, hardware and software. The steering group, for instance, had to actually design hardware, gears, chains, servos and stamps to deal with the torque unique to the car used for the robot. The vision had to deal with the difficulties of getting the camera to talk to the serial port once it had done the frame capture necessary to recognize an obstacle. Once all five systems were operable then a software system that allowed them all to work together to accomplish the overall goal of the reactive robot had to be designed. Solution design was the overriding issue for the students in this class.