GW Pre-College Summer 2011
Robotics

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Information

Description

This course explores the fundamental principles of computer science using robots. Students will focus on the process of programming behaviors for designing robots, while developing logic and problem solving skills that serve as a foundation for future study in a variety of disciplines. Students will learn Java and how to effectively use sensors and artificial intelligence techniques to complete a series of challenges. No programming experience is required. Students will also have the chance to interact with other robot platforms and learn about the most recent developments in computer science and robotics through guest lectures and site visits. Laptops are suggested.

Exercises

The majority of lab time will be spent working on two exercises. For the first week, students will have to program a robot to navigate a maze. During the second week, students will program robots to carry out a mock Search and Rescue mission.

Presentation

A the end of the course, each student will be responsible for giving a 15-20 minute presentation related to the future of robotics. In preparation for the presentation, the class will visit government research laboratories, Smithsonian exhibits, and perform research aided by the University's library and research staff.

Possible topics may include (but are not limited to):

Robots in the military
Economic impacts of robots in the workforce
Search and rescue applications
Robotic space exploration

Dates

The course runs from July 11th to July 22nd 2011. With exception of the last class, each class begins at 9 and ends at 3:30, with a break for lunch.

Classroom

Eckles 309

Attendance

Attendance is mandatory, and students are expected to arrive on time an prepared for the day's class. Exceptions will be made for medical absences and religious observation.

Field Trips

Students are required to bring money to purchase metro passes for use on field trips.

Schedule

Monday, July 11th

Introduction to robotics and class preliminaries.

- 0900 - 1030 **No Class**
- 1030 - 1100 **Lecture (James):** Introductions, class survey, and syllabus review.
- 1100 - 1200 **Hands-on:** Tutorial of the NXT platform, orientation with the robots, and basic challenges, such as edge and line following.
- 1200 - 1300 Lunch.
- 1300 - 1330 **Lecture (James):** What is computer science and robotics.
- 1330 - 1530 **Hands-on:** Building more complicated behavior with loops and sub-routines.

Tuesday, July 12th

Introduction to Java and programming, taught by Christopher Smith.

- 0900 - 1200 The Java language and how to programming, with exercises.
- 1200 - 1300 Lunch.
- 1300 - 1530 How to write Java programs for the robots, and robot specific considerations.

Wednesday, July 13th

Sensing the world and moving through it, lecture on robotics related research by a University Professor.

- 0900 - 0930 **Lecture (James):** How robots sense their environment and Computer Vision.
- 0930 - 1100 **Hands-on:** Sensors and movement exercises.
- 1100 - 1200 **Guest-Lecture:** Dr. Gabriel Parmer will give a presentation about his research in relation to robotics.
- 1200 - 1300 Lunch.
- 1300 - 1400 **Hands-on:** Begin maze exercise.
- 1400 - 1530 **Library Component:** Role of robots in society

Thursday, July 14th

Smithsonian visit and continuation of maze exercise.

0900 - 1000 **Field Trip:** Shuttle to Foggy Bottom, Metro to Smithsonian.
1000 - 1100 **Field Trip:** View robotics displays at Air and Space Museum.
1100 - 1200 **Field Trip:** View robotics and computer science related displays at the American History Museum.
1200 - 1300 **Field Trip:** Eat a packed lunch on the Mall.
1300 - 1400 **Field Trip:** Return to campus via Metro and shuttle.
1400 - 1430 **Lecture (James):** Review of trip.
1430 - 1500 **Lecture (Sara):** Sorting Algorithms.
1500 - 1530 **Hands-on:** Continue the maze exercise.

Friday, July 15th

Complete maze exercise and a guest lecture on ongoing undergraduate research in robotics.

0900 - 1000 **Lecture (James):** Problem solving and debugging.
1000 - 1100 **Guest Lecture:** Nathan Scott will give a presentation on the undergraduate research that he has been working on at GWU.
1100 - 1200 **Hands-on:** Maze exercise continued.
1200 - 1300 Lunch.
1300 - 1430 **Hands-on:** Completion of the Maze exercise.
1430 - 1530 **Lecture (James):** Robotics in Science Fiction and Popular Culture.

Monday, July 18th

Begin the Search and Rescue exercise and a lecture on robotics by a University Professor.

0900 - 1000 **Lecture (James):** Introduction to Artificial Intelligence.
1000 - 1130 **Hands-on:** Begin the search and rescue exercise.
1130 - 1200 **Lecture (Sara):** Ciphers.
1200 - 1300 Lunch.
1300 - 1400 **Guest Lecture:** Roboticist Dr. Evan Drumwright will discuss his current research in robotics.
1400 - 1530 **Hands-on:** Search and rescue exercise continued.

Tuesday, July 19th

Continue search and rescue exercise, learn about robotics competitions.

0900 - 0930 **Lecture (Sara):** Data Compression.
0930 - 1130 **Hands-on:** Search and Rescue exercise continued.
1130 - 1200 **Lecture (James):** Aerial robotics.
1200 - 1300 Lunch.
1300 - 1430 **Library Component:** Recent advances in Robotics.
1430 - 1530 **Lecture (James):** Robot sports and competitions (for high schools!).

Wednesday, July 20th

Visit to the National Institute of Standards and Technology (NIST).

0815 - 1000 **Field Trip:** Transportation to NIST, via shuttle and Metro.
1000 - 1230 **Field Trip:** Tour of NIST.
1230 - 1330 **Field Trip:** Lunch at NIST.
1330 - 1500 **Field Trip:** Return to campus via shuttle and Metro.
1500 - 1530 **Lecture (James):** Reflection on NIST visit.

Thursday, July 21st

Complete presentations and Search and Rescue exercise.

0900 - 0930 **Lecture (Sara):** Introduction to Scheme.
0930 - 1030 Time to prepare for presentation.
1030 - 1200 **Library Component:** Additional time to research presentation topics.
1200 - 1300 Lunch.
1300 - 1500 **Hands-on:** Complete Search and Rescue exercise.
1500 - 1530 **Lecture (James):** Review of course, and how to continue exploring robotics.

Friday, July 22nd

Student presentations. Half day only.

0900 - 1200 **Student Presentations:** The Future of Robotics
1200 - 1300 Lunch.