Project Year
2005

Project Team
Gregory Hager, Professor, Department of Computer Science, Whiting School of Engineering; Jonathan Lasko, Student, Department of Computer Science, Whiting School of Engineering; Christopher Pitman, Student, Krieger School of Arts and Sciences; Brendan O'Connor, Student, Department of Computer Science, Whiting School of Engineering; Joseph Romano, Student, Department of Computer Science, Whiting School of Engineering

Project Title
Robot Soccer Simulator

Audience
Undergraduate students in the *Artificial Intelligence and Robotics* class and the proposed new course, *Robots: Motion Planning and Mapping*. There are also related courses taught in the Mechanical Engineering department that may be able to use these materials.

Pedagogical Issue
A central factor limiting robotics classes is the difficulty of implementing students' work. Loading code onto robots to test it is time-consuming and ineffective for a large class.

Solution
A simulation package providing a ready environment in which instructors could create assignments would make classes in artificial intelligence much more versatile. Instead of having to load their code onto actual robots, students could download the simulation package and test their code as they developed it. This project proposes continuing a previous Technology Fellowship Project program written by JHU graduate Alan Chen—a basic simulator in which a user could create a representation of a robot. The team will build on Alan's work, extending his original project to a robotic soccer environment.

Technologies Used
Wireless Networking, C/C++, Graphic Design, MatLab, Digital Video, Animation

Project Abstract
A major arena for international robotics research is RoboCup, the World Cup Robot Soccer League. Playing a sport such as soccer has allowed researchers to address many of the different fields of robotics research, among them vision, coordination, path planning, and communication. Professor Hager's use of a robot soccer simulator in his robotics classes will familiarize thirty or more students per class with a popular research problem. Students who are intrigued by the problem can continue to pursue their work as part of the Johns Hopkins RoboCup team, which has experienced a recent surge of growth and now has sufficient student involvement for a year-round team development effort. For the proposed project, during the 2005-2006 school year, three students will work on extending Alan Cheng's original

Technology Fellowship Project-developed simulator to a soccer environment, creating a basic representation of a RoboCup mid-size robot like the ones used by the JHU RoboCup team, and creating basic artificial intelligence to simulate game situations, including support for opponents and teams. The simulator will be divided into five sections. The 3D graphics engines will be developed by Brendan O'Connor. The interface between robot AIs and gameplay will be developed by Jonathan Lasko, as will networking (allowing the AIs to run on separate computers). Physics will be written by Chris Pitman. Finally, all three students will collaborate on the gameplay module, controlling the actual logic of the game. (Note that this project is being submitted as a fall/spring project.)

The overall goal of the two proposed TFP projects, Robot Soccer Simulator and RoboModule, is to develop and package essential aspects of the Robocup code so that future students can build on it for their own projects within engineering classes and Robocup competitions. Professor Hager uses Robocup and Robocup-based code in his *Artificial Intelligence and Robotics* class. The proposed projects (both the code interfaces and the simulator) will be useful in this respect. There are related courses taught in the Mechanical Engineering department that may also be able to use these materials. In the longer term, Professor Hager's intent is to create a course entitled *Robots: Motion Planning and Mapping* which would make use of these tools for course exercises.