Kansas State Robotics

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Abstract

The robotics team from Kansas State University consists of three undergraduates, one graduate student, and a faculty advisor from the Department of Computing and Information Sciences. The group intends to compete in the "Find the Remote" event at this year's AAAI 97 Mobile Robotics Competition in Providence, Rhode Island. Kansas State University has participated in each of the last four competitions, placing two teams (second and third place) in last year's "Office Delivery" event. This year's team has two principal goals: to win the "Find the Remote" event and to provide a solid foundation on which to build future entries.

Software Control Laboratory[1]

The Computing and Information Sciences Department at Kansas State University has developed a software control laboratory for the purpose of exposing undergraduate students to the problems of developing software on real, moving equipment. The moving equipment in the laboratory consists of two Nomad200 robots from Nomadic Technologies Inc. (Mountain View, CA). The main use of the equipment is in a capstone, two-semester software engineering sequence. Approximately 60 students a year take this course and work in teams of 4-6 students. In this course, teams of students develop software to control the robot in tasks such as maze exiting or office delivery. In the last few AAAI Mobile Robot Competitions, the tasks have been similar to projects in the course.

Hardware

The group's test platform is a Nomad200 mobile robot, a commercial system designed and built by Nomadic Technologies Inc. The Nomad200 consists of a base unit, capable of translation and steering motions, and a moveable turret, also capable of rotation, on which all sensors are mounted. Two arrays of sixteen ultrasonic range sensors are mounted along the turret's circumference and provide information about the distance to any obstacles in the robot's vicinity. There are three CCD cameras mounted on top of the robot's turret; one is color, the other two are monochrome. All processing is carried out on an Intel-based Pentium 133MHz mainboard, which is equipped with 32 megabytes of main memory and a wireless Ethernet interface.

Software

This year's team is taking a model-based approach to object recognition, while a simpler reactive navigation scheme will be used to guide the robot around obstacles, and through the environment. One of the more difficult challenges will be to make efficient use of limited hardware resources, while successfully dealing with time constraints imposed by the event rules. Machine vision requires a relatively large amount of processing power, and so will be used rather sparingly. Most navigational activities can be adequately handled with information from the ultrasonic sensors. The reduced computational requirements will allow for quick reaction to obstacles and a faster movement from one part of the room to another.

Future Work

As was mentioned earlier, a second, and equally important goal of the team is to provide a solid base of reusable software on which future software may be built. Object-oriented design techniques are being used to build classes that encapsulate not only the functionality of various hardware items (such as cameras, sonar sensors, and the robot itself), but also of behaviors (both low-level reactive, and higher-level deliberative), and more abstract concepts (for example, images and topological maps). These objects will be used in the software engineering course and hopefully by future teams in the AAAI Mobile Robot Competitions.

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