Team Description Paper (TDP)

The Omega Bots RoboCup Team
Matt Duggan
8120 Glengarriff Road
Clemmons, NC USA
(336)712-0493
ktentrpr@aol.com

Research Topic Description

The topic under study is the Strategy and Organization of Multi-agent Systems. A practical example of a multi-agent system is the RoboCup competition, where there are four robots working together against four other robots to win at soccer. This research project investigates the alternative organizational strategies a team of robots can utilize. For instance a simple strategy is for the team to work as a swarm with each robot having identical behaviors. On the other extreme, a highly complex structure would be for each robot to have their own positions to play, with each position having a different set of behaviors that the robot needs to be proficient in. Similarly complex, a team could run pre-designed plays, which involve the coordinated behavior of all or some of the players acting in concert to be successful. The optimal strategy though, may actually be dependent on the robot's abilities and the computer hardware. For instance, if the robot is not highly skilled at passing the ball, then coordinated plays that require accurate passing may not be successful. In which case, a less complex approach with multiple robots trying to move the ball down the field may be more successful. The computing speed may also influence which approach will be successful. If it takes extended computational time to determine where the ball is on the field, then by the time location is available, the ball may have rolled to a new position. This investigation will review the benefits and disadvantages of various common strategies, and quantify the factors that may favor a particular strategy over another. Then a particular strategy will be implemented in the robot team during the competition and an evaluation of its performance made during the tournament games

Robot Description

Each robot is designed to move freely around the field and locate the other players and the ball using a color vision system. A special ball moving mechanism is employed to direct the ball in the desired direction. A set of six ultrasonic sensors are used to avoid collisions by determining the distance to any object in

the area of the robot. In addition, six contact sensors are mounted on the base to detect physical contact so the robot can move free from an entanglement. The locomotion is provided by a two wheeled base driven by 12 volt motors with gear reducers. Optical sensors track the rotations of the wheels to determine the velocity and distance travelled of each wheel. For accurate orientation information, an electronic compass is mounted on the robot. The robot's controller, an OOPic single board computer, monitors the sensors and controls the drive wheels, and the ball manipulator. Each robot carries a wireless video camera that transmits their current view of the game. An off-field computer receives the video images and uses it to determine the location of the ball and players on the field. This information is then communicated to the individual robots. The off-field computer also makes strategic decisions for the team and gives assignments to specific robots.

Status of Team

Currently the robot design has been completed, including the design for the ball moving mechanism, the robot base, and the specification of the sensors and actuators, the robot control computer, the vision system, and the communication methods. One prototype robot has been fabricated and assembled and is under going proof-of-concept testing. After this is completed, four more identical robots will be fabricated, and the team will be complete.

Communication Frequencies Used: 2.4 GHz