Soccer robots compete for the title

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At RoboCup, automated bipeds are one of many types of robots competing for the title. Credit: Fraunhofer IAIS

Robot soccer is an ambitious high-tech competition for universities, research institutes and industry. Several major tournaments are planned for 2008, the biggest of which is the 'RoboCup German Open.' From April 21-25, over 80 teams of researchers from more than 15 countries are expected to face off in Hall 25 at the Hannover Messe.

In a series of soccer matches in several leagues, they will be putting the latest technologies on display. The tournament is being organized and carried out by the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS in Sankt Augustin.

For a machine, a soccer match is a highly complex endeavor. Robots must be able to reliably recognize the ball, the sidelines and the goalposts in addition to distinguishing between their teammates and opponents. To this end, they are outfitted with all sorts of high-tech equipment: cameras and sensors scan the robots' surroundings, internal processors convert data to define game tactics and defense strategies, and innovative engines allow the automated players to sprint across the field and unexpectedly fake out their opponents.

There are now nine leagues, each of which has its own technological focus. In the middle-size league, robots get around on wheels. Four players and a goalkeeper compete for each team on a 20 x 14-meter pitch with standard soccer goals. They must be able to function completely independently and are equipped with internal camera systems that process information in real time. What's more, the robots can move up to two meters per second.

Other automated soccer players, such as Sony's robotic dog Aibo, run on four mechanical paws. And two-legged robots have been competing against each other at the RoboCup since 2005. "These humanoid robots have come a long way in recent years," says Dr. Ansgar Bredenfeld, who is in charge of the RoboCup at IAIS. "Just like real players, they fall down and get up again, go after the ball autonomously and score goals."

The RoboCup is more than just a soccer tournament. Since 2006, there has been a 'RoboCup(at)Home' category, a competition for service robots. In a replicated room, the robots must access refrigerators, collect garbage and recognize people. And in the 'RoboCup-Rescue' category, rescue robots must complete an obstacle course.

"RoboCup stimulates technological development in a way that wouldn't otherwise be possible," says Professor Stefan Wrobel, Executive Director of IAIS. "Many components that were originally designed for robot soccer have since made their way into other applications, for instance in localization technology for inspection robots." Robots that can mow the lawn on their own or collect samples from the ocean floor for marine researchers are also equipped with RoboCup technology.

Participants under 20 years of age have their own competition, ‘RoboCupJunior’, which runs at the same time as the ‘RoboCupSenior’ tournament. In addition to fighting it out in a robot soccer tournament, the future generation of scientists will be competing in the RoboDance (robot dancing) and RoboRescue (obstacle course) competitions. These events are extremely popular: about 300 teams have registered for this year’s competition. To participate in Hannover, teams must qualify at one of three tournaments. “Germany has a serious problem: it lacks tens of thousands of engineers,” Wrobel points out. “RoboCupJunior is a very important event, as it sparks young people’s interest in technical degree courses.”

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