

Graz University of Technology will stage the world championship of intelligent robots from 29 June to 5 July 2009

Robots can play football: on two legs, on wheels or “virtually” on a VDU. And they can also dance, carry out simple manual household tasks and even save human lives. For one week at the end of June, Graz will become an international centre for robotics – as host of the RoboCup 2009. There is free entry to the whole event for visitors.



Sports, games and excitement: humanoid robots in action

The RoboCup is the biggest robotics event in the world and combines games, sport and science in a unique way. The Austrian premiere of this ultimate of scientific events is from 29 June to 5 July 2009. The host is Graz University of Technology. Some 3,000 participants from over 40 countries are expected to take part with their round 700 robots in the competitions in various disciplines. The main focus is on football but there are also competitions in service and rescue robotics as well as robotic dance contests for children. The events will take place at the Graz Trade Fair Centre, where the accompanying scientific conference, the RoboCup Symposium, will also be hosted. The competitions and supporting programme will take place in two large halls totalling over 33,000 square metres. Apart from the competitions, there will also be discussion events on robotics, technology presentations and future prospects. Furthermore, in co-operation with Kunsthaus Graz, there will be a programme highlight on the topic “Robotics meets Art”.

The Origin of the Initiative

The RoboCup is a project of the international scientific community which is intended to strengthen and promote education, research and development in the fields of artificial intelligence and robotics. It's far-sighted vision is to develop a team of completely autonomous, humanoid robots which can beat the human football world champions by 2050. Although football was chosen on purpose

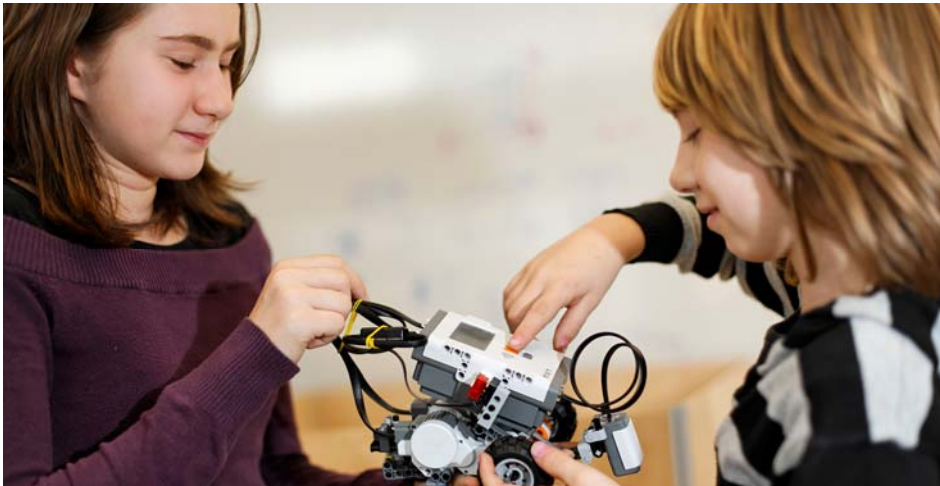
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RoboCup 2009 Graz
Alice Senarclens de Grancy
Press Officer
press@robocup2009.org
Phone: +43 316 873 6006
Mobil: +43 664 60 873 6006
<http://www.robocup.org>

because of its great popularity as a scenario to promote robotics, the RoboCup is not an entertainment project but a serious, scientific initiative with high-class international participation.

Why Machines Play Football

Football requires operating actively in a real environment. A football robot has to recognise objects, localise itself and other players, react to unforeseen events, plan its path and move itself. In the very complex field of robotics, a variety of specialists work in close co-operation: computer scientists, electrical engineers and mechanical engineers in particular carry out research and development of robots. In computer science, the field of artificial intelligence – the automation of intelligent behaviour – is extremely relevant. Put in simple terms, machines are supposed to learn, think creatively and solve problems – just like humans.



There are own competitions for children, for instance the Rescue Ligue

How Humans Benefit from Robotics

The technological developments of the last few years have enabled an upsurge in the field with many applications already being implemented in practice: modern industrial robots carry out monotonous assembly-line work at fast speeds and with high precision. Cars are built with the “assistance” of robots. Robots are being increasingly deployed in work dangerous for humans. Robots are used in investigations, operations and rehabilitation in medicine, and explore inaccessible areas, including distant planets in research. Finally, service robots make daily life easier in terms of practical help: they vacuum the apartment and mow the lawn.

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The Different Leagues

RoboCupSoccer

Football is the declared summit of the RoboCup. The complexity and popularity of the team game was also an important motivation factor that led to the beginnings of the RoboCup in the mid-1990s. There are altogether five different leagues in RoboCupSoccer:



Simulation League

In this league, two purely virtual teams with eleven completely autonomous players each play against each other in both 2D and 3D simulations. The idea of the simulation league is to collect experience in strategies, tactics and group behaviour in order to transfer this to humanoid robots. The scientific focus lies on the co-operation and communication between the virtual players.

Small Size League

Two teams with five rolling robots each – this is what the small-size league looks like. The players only have a limited number of sensors on board, and they receive information from cameras positioned above the field of play. This information is sent to an external computer which in turn sends commands to the robots via radio control. In this league, the sky's the limit for research teams developing their robots: there are no restrictions on materials, shape and software. Only size is specified; in other words, the width and height of the robots. Due to control by means of external computers, the players in this league are semi-autonomous.

Football remains in the focus: the simulations team of Graz University of Technology

Middle Size League

In this the king's discipline of the RoboCup, the teams are composed of six medium-sized robots with all sensors on board. Players in this league weigh up to 40kg and have their own cameras mounted on board by means of which they have to localise themselves. This is the difference to the Small Size League, where an overhead camera perceives the positions of all the players.

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Communication between the robots takes place by means of WLAN, and external interventions by humans are not allowed. As a rule, each robot has a computer which collects and interprets the information from the sensors, combines it with the already available knowledge and derives new actions. The scientific challenge in this league lies in the combination of developed hardware and appropriate software.



Playing in the "king's discipline": the „Mostly Harmless“ team of Graz University of Technology

Standard Platform League

The great advantage of this league for participants is at one and the same time the greatest challenge: all teams use identical robots. And this year is the first time for the two-legged "Nao." He is the successor of "Aibo" the robotic dog that has been used up to now and who is now going into a well earned retirement. Since the hardware is the same for all participants, this competition is about the further development of software. Group dynamics, co-operation and strategy are once again central features. The robots act autonomously, and only communication by WLAN is allowed.

Humanoid League

This league is for humanoid robots – robots with human-like body shapes and fitted out with the appropriate sensors. Players are completely autonomous and human intervention in the game is not allowed. What is specially tricky about this league is that players must be able to keep their balance on two legs, whether they are standing, running or kicking the ball. And if they fall over, they have to be able to right themselves. The humanoid robots are divided into two size classes: KidSize (under 60 cm) and TeenSize. Just as in the Middle Size League and the Standard Platform League, humanoid robots carry their sensors – their cameras and computers – directly on their bodies during the fast game and the camera pictures are correspondingly wobbly. The greatest difficulty for robots of all three leagues is to filter out the most important sensory data, interpret it correctly and act on it.

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Robots as butlers: the Vision of assistants for the household

RoboCup@home

This discipline, which was first held in 2006, places the focus on applications suited to daily use and human-machine interaction with autonomous mobile robots. The aim is to develop useful robotic applications which can support humans in daily life. In the competition, participants can first present the abilities of their robots which they have chosen themselves in the Open Challenge. If they make it into the final, the robots have to pass various tests. Up to now, the model of a simple apartment has been used as an environment; in the future, however, other "real" environments, such as gardens, streets or supermarkets might be used in the competition.

RoboCup Rescue

Robots can rush in where humans fear to tread – for instance in rescue missions following natural disasters. The chief aim of the RoboCupRescue section is to promote and encourage research and development in the field of rescue and disaster-relief operation. This includes, among others, robots for search and rescue tasks, the co-ordination of various task forces and decision-support

systems. Currently there are two RoboCup leagues creating the future of digitally supported rescue operations: the Rescue Simulation League and the Real Rescue League.

Rescue Simulation League

The Simulation League is principally an international testing ground for simulating robots which carry out search and rescue operations in urban environments. Intelligent "agents" have to solve various search and rescue tasks in virtual catastrophe worlds. The research aim is to give decision support in emergencies by integrating disaster information and prediction, planning and human co-operation. The background research is carried out at a strong interdisciplinary level; for instance, behavioural strategy proves to be a difficult challenge when several research areas are involved.

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Real Rescue League

The idea behind the Real Rescue League is to deploy semi-autonomous search and rescue robots in a life-threatening environment after a natural disaster. Heat, dust and collapsed buildings can make a rescue mission using humans or animals just too dangerous. The rescue robots are meant to gather information which serves the emergency task force as a basis for making decisions. The RoboCup competition in this league can be described as follows: a team of several autonomous robots moves around in a specially built test environment which is divided into areas with differing grades of difficulty. They "search" out victim dummies, put together a map of the environment and send information back to the human operators.



„Rescue“ at RoboCup: robots avoid obstacles and look for “victims“

RoboCupJunior

Here, the youngest robotics experts get a chance. Most of the fun is about direct contact with the technology; nevertheless, the RoboCup juniors can measure themselves in three different competitions. Children and young people up to 19 are given a playful insight into the exciting world of robotics and can experience the technology themselves, both software and hardware. Instead of sitting alone in front of a computer, it's totally different in the RoboCupJunior competitions: here, emphasis is placed on teamwork. For the robots' construction, the pupils have access to a special construction kit based on the "Lego" principle. But many participants want to aim higher and build their players themselves using specialist support over several months.

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Soccer League

Even the smallest children play football. In the Soccer League of the RoboCupJunior, pupils in teams of pairs play against each other with autonomous, mobile robots they've built themselves. The ball is the size of a tennis ball and it transmits infra-red rays. The robots recognise the rays, know exactly where the ball is and thus raise the chances of scoring a goal. The size of the playing field depends on the composition of the team. Even here the kickers have to play alone: their supervisors are only allowed to watch from the edge of the pitch.



„Dancing Stars“: pupils with their robots in the „Dance League“

Dance League

Children can live out their creative side in the robotic dance competitions. They can dress up their robots and learn a specially created choreography with them. Complete stage sets may even be prepared over several weeks. The performances are supposed to be creative, but it doesn't matter whether sung, danced or improvised, a story has to be told in which at least one robot appears. The pupils are given a lot of creative room, but the duration of the performance is limited to one to two minutes. The performances are evaluated by a jury. The whole impression of the performance is what counts, but this also includes technical knowledge, which is tested by the jury in interviews.

Rescue League

The Rescue League category is just like the league for the grown-ups – the development of rescue robots. The autonomous devices have to follow a black line over a course which leads them onto two different levels by means of ramps. On the journey, the "victims" are lying on the line in the form of coloured paper figures. The robots have to recognise and indicate them. Obstacles, hairpin bends and interruptions on the black guiding line provide further challenges. In this competition, three things count: collecting points, covering the course – and if possible, being the fastest team.

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