www.eurathlon.eu

Resource for Teachers: The Story & Lesson Plan

Recommended for Secondary Education Years 9-10 (ages 13-15)

Teachers can also easily adapt this resource to use with younger or older students.

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Learner Outcomes/Objectives:

After this activity students are expected to:

- Understand what real-life robots are able to perform and realize how different this is from expectations raised by fictional robots in the literature and film.
- Apply this understanding to a realistic search and rescue situation and ascertain what role real robots could play in it.
- Be aware of the importance of competitions such as euRathlon for the advancement of robotics.

Rationale

The euRathlon project aims to advance robotics by means of realistic outdoor search and rescue scenarios where robots are put to test and compete with each other. The series of euRathlon competitions will provide the context for a much needed benchmarking[1] process that is highly important and necessary for this advancement, as it will make it possible to quantify the progress of the field in terms of the performance of the robots when faced with standardized tasks to perform. These competitions provide at the same time an exceptional opportunity for the public and young people to engage with realistic robotics. This activity is one of the various ways in which the euRathlon project aims to fulfil its remit of disseminating the real state of the art in robotics, in contrast to the prevalent perception of humanoid fully autonomous robots that only exist in fiction. In fact, one of the participant robots and winner in the autonomous navigation challenge at euRathlon 2013 did not look like anything other than a car (example fig.1).

fig 1. Autonomous (driverless) car.
Photo: euRathlon

[1] Benchmarking is the process of comparing different robots with standard performance tests.

Introductory Story – Part I

fig 2. Robot at EuRathlon 2013 in Berchthesgaden. Photo: euRathlon

Once upon a time, in a small village high in the mountains, something extraordinary happened. The day started like so many others, the smell of burning wood and the morning mist were about to give way to a clear and sunny day, when it all began. First, only a few kids noticed: curious little machines were being unloaded from vans and trucks here and there. When their number became clearly conspicuous everyone in the village started to realize: robots were taking over the town! But wait – doesn´t this happen only in the movies?

Indeed, robots were not actually invading the village. Rather, they were brought in by the guys who design and make them, and were gathering in order to take part in euRathlon 2013, an international competition of robots, as some men in overalls explained while they were setting up the tent where the teams would have their headquarters for a week and meet between the different challenges in which they would have to take part. It was also the place where the final preparations of the robots were made for the challenges. Did you know that there even were free “eyesight tests” for robots available?

Teaching point 1

Address the following questions with the students, either with a directed discussion in class, or as homework for the students to investigate:

- Why and how does a competition help scientists and engineers advance the field of robotics?
- Taking into account that the competition is meant to push the boundaries of what robots can do – what kinds of challenges do you imagine robots participating in a euRathlon competition might have to cope with?

Answers can be found in www.euRathlon.eu, but other sources can be used by students to base their answers on.

fig 3. An eyesight test for robots demonstrated at Eurathlon 2012. Photo: Erik Stengler

Introductory Story – Part II

For a whole week robots, supported by their respective teams of engineers, were seen training and preparing themselves for the 4 different challenges:

- Urban reconnaissance and rescue
- Manipulation and handling of hazardous materials
- Search and rescue in a smoke filled underground structure
- Autonomous navigation

One of the trials was about search and rescue in a smoke filled environment. The robots had to enter the abandoned railway tunnel of the village – one of the reasons why the competition was being held there – find the body of an unconscious victim, represented by a dummy, and report back on its location. It was the turn of the robot of team number 15.

For this challenge the robot was set to be remotely controlled by an operator. The team member assigned to do this took the controls and, both excited and nervous, led robot 15 into the tunnel. For some minutes, not much could be seen on the screen on which 15's vision was displayed. Then it switched to infrared vision, and the whole scenario within the tunnel appeared in front of 15's eyes, and of those watching the screens outside.

Soon the image began to shake: robot 15 seemed to be trembling with excitement, too! But wait – can a robot feel and express excitement? Before anyone asked themselves this question the real reason for the trembling became apparent: not only the image on screen was shaking, but the screen itself, and the camping table on which it rested, and all the equipment!

Now everyone in the area could feel it in their legs… an earthquake was taking place! It was a mild one – no major destruction or damage occurred and after the initial shock it was decided to continue with the competition as planned. Local officials assured everyone that earthquakes are very uncommon in this geological area, and never in recorded history have they had major consequences beyond some loose bookshelves breaking off walls and some cabinets tipping over.

Everyone turned back to the screen with 15's vision. But the image showed something very different from what 15 was "seeing" when the ground started to tremble.

It did not take long for someone to recognize that what they were seeing was a patch of the ceiling of tunnel. The operator zoomed in. In more detail now, the image showed that several bricks were missing in the ceiling. In that instant they could also see how some more were breaking off, leaving a cloud of dust along their free-fall path to the ground. It was immediately clear that the earthquake had been able to loosen several parts of the ceiling of the old unmaintained tunnel. Some of them must have fallen on top of 15 and knocked it off. It was lying now on its back, and obviously unable to move…

Health and safety regulations would not allow humans to enter the tunnel until the smoke cleared. Even so, the lead engineer of team number 15, who had developed a strong attachment to her robot, rushed into the tunnel before anyone could even try to talk her out of it. Almost everyone gathered at the entrance of the tunnel calling out her name, asking her to come back. No answer came back, no footsteps could be heard, and the clock was dangerously ticking, with the engineer's chances of survival shrinking by the second. After the initial chatter of concerned officials and members of the organisation suddenly an eerie silence set in as the seriousness of the situation was gradually being realized.

Robot 15 was almost fully disabled and an anxious engineer was wandering helplessly inside a smoke filled tunnel. The very scenario this challenge was meant to mock up to put to the test the robots' ability to serve in search and rescue, was now happening for real!

[2] See for example http://earthquake-report.com/2012/02/27/moderate-very-shallow-earthquake-in-alpes-maritimes-area-france/ for a moderate earthquake occurrence in the French Alps in early 2012.

Teaching point 2

Again, this lends itself to a class discussion or to an assignment for students to investigate, either individually or in groups.

› Why do you think the engineer had developed a strong attachment to the robot? Do you think you could feel such an attachment towards a robot like the ones participating in euRathlon? What about robots like those shown in the movies? Why do you think scientists are actually concerned and considering issues of attachment between humans and robots?

For an approximation to this and other ethical issues on robotics, visit:
http://www.teachwithmovies.org/snippets/sn-sci-robot-ethics-robot-and-frank.html

Or see the draft Principles of Robotics:
http://www.epsrc.ac.uk/research/ourportfolio/themes/engineering/activities/Pages/principlesofrobotics.aspx

› What do you suggest as a solution to the situation in the story? Consider and discuss possible search and rescue operations based on real capacities of current robots such as those taking part in euRathlon. This could be done as a role-playing game in which different groups (of 2-3 pupils) in the class take up the roles of the different teams participating. As a homework the sudents could be asked to familiarize themselves with the robot of their team and specifically with its capabilities, bringing along to the next class a data card with the basic information on the robot and, most importantly, its capabilities. A discussion can the take place in which each team suggests solutions its robot can contribute towards rescuing robot 15 and its engineer.

For information on participants and their capabilities, visit:
http://www.elrob.org/eurathlon-2013-teams

› The story can then be finished, either in class or as homework.