ICT Results ... Results that lead the way

Features

Light-based localisation for robotic systems

Getting robotic systems to accurately detect both moving and static objects remains an obstacle to building more autonomous robots and more advanced surveillance systems. Innovative technology that uses light beams for localisation and mapping may offer a solution.

The technology advances the current state of the art of Light Detection and Ranging (LIDAR), the optical equivalent of radar in which reflected beams of scattered light are used to determine the location of an object. Whereas most LIDAR systems use a one-step process to detect objects by scanning an area and measuring the time delay between transmission of a pulse and detection of the reflected signal, researchers working in the EU-funded IRPS project added a prior step.

They use LIDAR to first build a 3D map of the area, enabling their system to pinpoint the location of not just static objects but also moving ones – be it a human, an open window or a leaking pipe – to within a few millimetres. The researchers, from four EU countries and Israel and Canada, have called the technology 3D LIMS (3D LIDAR Imaging and Measurement System) and foresee a broad range of applications for it, from navigating autonomous vehicles around airports to monitoring industrial equipment and enhancing security surveillance.

"This two-step LIDAR process, involving first calibration and then real-time navigation, is the key innovation. It allows the system to accurately and rapidly detect changes in the environment," explains Maurice Heitz, the manager of the IRPS project and a researcher at French technology firm CS Communication & Systèmes.

The technology not only detects objects with greater accuracy, but unlike camera-based robotic vision systems it is not affected by shadows, rain or fog, and provides angular and distance information for each pixel, making it suitable for use in virtually any environment.

Robotic airport buggies

To highlight the potential of 3D LIMS, the IRPS team built a prototype application in which the technology was used to navigate buggy-like autonomous vehicles that might one day transport passengers or luggage around an airport.

Showcased at Faro Airport in Portugal last December, the robotic porter application involved first building up a 3D image of the airport environment so the system would know the location of static features such as walls, columns, doors and staircases. The buggies then use onboard LIDAR to accurately calculate their position and detect obstacles as they move around the airport.

"Our vision is that one day people, perhaps elderly or with a disability, will go to the airport and by speaking to a porter control centre on their mobile phone or through a web interface on their PDA would be able to order a vehicle to take them to their boarding gate. The vehicle would transport them autonomously, weaving its way between moving objects such as passengers and piles of luggage," Heitz says.

The IRPS project manager notes that there is real demand for such a system by airport operators, who are finding it increasingly hard to meet the transport needs of passengers and their luggage because of the large size of modern airports. However, he says it will probably be many years before robotic buggies start buzzing around airports autonomously due to a combination of safety concerns and the need for further technological advances.

"Running a 3D LIMS system requires a lot of computer processing power and a large investment," he notes.

Other applications are closer to market. In the field of security surveillance, 3D LIMS could improve upon current techniques for detecting intruders or spotting changes inside a building.

"The system compares the current acquisition [of reflected light] to its reference acquisition, allowing it to detect any change in the environment," Heitz says.

In the case of industrial monitoring, for example, a 3D LIMS system operating in a power plant would be able to instantly and accurately detect something as small as a leaking pipe.

Though the project partners say commercial applications for their system are still a few years away, they are

continuing to work on the technology and are seeking support for further research and development.

The IRPS project received funding from the ICT strand of the EU's Sixth Framework Programme for research.

INFORMATION :

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PARTNERSHIP SOUGHT: Further research or development

USEFUL LINKS: IRPS project
IRPS fact sheet on CORDIS

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