ERC project OFAV

When green driverless vehicles shape our future mobility

One day, there may be cities with driverless cars that will safely take us to our destination while avoiding accidents and traffic jams. There will be driverless tractors which will be able to work on the fields 24/7 and driverless engines which will run dangerous or extreme missions to save people. To progress in this field, extensive tests must be performed and scenarios designed. Back in 2010, a unique test had already been conceived by Prof. Alberto Broggi, who was awarded an ERC Advanced Grant in 2008: four autonomous cars left Italy and reached Shanghai (China) after a 13,000 km and three months' trip. The objective of such an exercise was to demonstrate in real conditions that the current technology is mature enough for the deployment of non-polluting and no-oil based vehicles.

To respond to critical situations that happened during this long journey through eight countries, Alberto Broggi's team has performed new tests to make the system more stable and robust. Extra effort is put in the design and "behaviour" of the vehicles. Two similar vehicles - each with a specific goal - moved at the same time during the trip. The first one drove autonomously in selected roads and was devoted to data acquisition while the second one automatically followed the route defined by the preceding vehicle, requiring no human intervention. The second car could thus be considered as a ready exploitable engine, able to move on loosely predefined routes.

All data produced by the sensors and GPS flow were logged in a unique database of very diverse scenarios of more than 20 TeraByte. This database will be used by Broggi's team to test additional driver assistance systems in the future.

One of his vehicles is being showcased at the Innovation Convention's exhibition.

ERC grantee: Alberto Broggi

Host institution: Universita degli studi di Parma, Italy

ERC project: Open intelligent systems for future autonomous vehicles (OFAV)

ERC call: Advanced Grant 2008

ERC funding: € 1,751,066

More information on: http://erc.europa.eu/succes-stories/europe-china-13000km-pioneering-expedition-driverless-vans-led-erc-grantee-reached-en

Visit the researcher's webpage: http://www.ce.unipr.it/people/broggi/index.php

Meet Alberto Broggi and discover his driverless car on stand no. 28 under the "Smart and Green transport" exhibition section.

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ERC project E-SWARM

Robots get closer to our everyday lives

The discipline that lies behind natural systems composed of many individuals that coordinate with each others and with the environment, is now largely known by scientists. It is called “swarm intelligence”. Several researchers have been studying the insights of collective behaviours of colonies of ants and termites, or flocks of birds and herds of land animals. Some human artefacts also fall into the domain of swarm intelligence, notably multi-robot systems and also certain computer programmes that are designed to tackle data optimization and analysis. Swarm intelligence is what Marco Dorigo, who was awarded an ERC Advanced Grant in 2009, has been working on for several years.

Initially developed through funding from the EU’s Sixth Research Framework Programme, his project is now being pursued thanks to ERC-funding. The E-swarm project is a heterogeneous swarm robotics system composed of three different robot types with complementary skills: foot-bots (specialised in locomotion and capable of transporting objects), hand-bots (capable of climbing vertically and manipulating small objects) and eye-bots (autonomous flying robots capable of attaching themselves to the ceiling, analysing the environment and gathering information inaccessible to the other two types of robots). The system is not centrally controlled, i.e. it relies on continuous interactions to produce collective self-organised behaviour of robots.

Concrete applications of this research project could one day include rescue operations after natural disasters or space exploration.

During the exhibition, Marco Dorigo will show the three prototypes developed by his team, as well as give live demonstrations of some of these collective behaviours. The prototypes are also considered to be innovative hardware platforms as they can are able to evolve in complex situations, navigate autonomously in an environment, connect to others and avoid obstacles (see video: http://www.youtube.com/watch?v=M2nn1X9Xlps). They can climb on a shelf, as well as manipulate or extract objects. Some tests are currently being done to increase the number of robots used, as well as their functionalities.

ERC grantee: Marco Dorigo

Host institution: Université Libre de Bruxelles, Belgium

ERC project: Engineering Swarm Intelligence Systems (E-SWARM)

ERC call: Advanced Grant 2009

ERC funding: € 2,016,000

More information on: http://www.e-swarm.org/

Visit the researcher’s website: http://iridia.ulb.ac.be/~mdorigo/HomePageDorigo/

Meet Marco Dorigo on stand no. 46 under the “Robots of the future” exhibition section.

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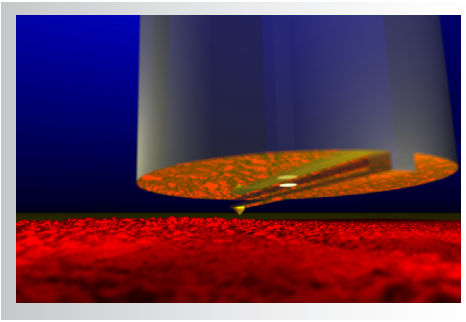
ERC project FTMEMS

A new generation of miniaturised fibre-top devices is on its way



The ultra small could one day be exploited to solve the biggest problems. Fibre-top sensors, which are a new generation of miniaturised devices made of tiny mechanical movable structures on the tip of an optical fibre, have secured their future in several domains. The light coupled at the opposite end of a fibre allows users to detect the smallest movements of the structure, such as accelerations, vibrations, incoming airflows, change of pressure and eventually biological or chemical hazards. Thanks to their compact dimensions and the absence of electronics on the sensing head of the devices, fibre-top sensors adapt well to harsh environments: liquids, extreme temperatures, explosives, electromagnetic and noisy environments etc. They are also very small and handy, a major asset for applications beyond research laboratories.

Dr. Davide Ianuzzi and his team had been working on a prototype at the VU University Amsterdam for two years, when he was awarded an ERC Starting Grant in 2007. Despite several technical obstacles, the researchers have invented and patented two fabrication methods for producing series of mechanical structures for fibres and have explored how the technology could be used for a range of applications. For example, they have implemented a humidity sensor for research laboratories, a pressure sensor for vacuum measurements and a flow meter for wind tunnels. They are now working at developing an accelerometer for measuring vibrations in large mechanical structures. It will be tested to monitor small seismic movements that occur before major landslides (in collaboration with the University of Padua) and to detect leaks in gas pipelines (in collaboration with the University of Warsaw). Other studies are under way to assess the performance of fibre-top devices in biochemistry.

Another major contribution of the project is in the area of atomic force microscopy, where it is now possible to “see” the bumps of a disk that are one millionth of a millimetre and obtain images at the nanoscale. As for a vinyl player, the tip anchored to the hanging end of a lever is only a few tenths of millimitre long and has a radius of curvature of only a few atoms. Such simpler and less expensive fibre-top technology could solve some of the problems faced by laboratories today, and thus reduce the number of components and the costs of the device. This technology could also be miniaturised to the dimensions of a portable instrument, opening new possibilities for the medical sector for instance.

Its commercial potential is also high. Dutch entrepreneur Hans Brouwer and Davide Iannuzzi founded Optics11 in April 2011 – a spin-off company based in Amsterdam to bring fibre-top technology to market.

ERC grantee: Davide Iannuzzi

Host institution: VU University Amsterdam, The Netherlands

ERC project: Fiber-top micromachined devices: ideas on the tip of a fiber (FTMEMS)

ERC call: Starting Grant 2007

ERC funding: € 1,799,915

More information on: http://www.nat.vu.nl/CondMat/iannuzzi/people/iannuzzi.php

Meet Davide Iannuzzi on stand no. 37 under the “Competitiveness and Industrial leadership” exhibition section.

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ERC project TEMPUS_G

Improving health and sports performance through the brain's control

Every movement we make, such as moving our eyes to read this text or reaching out to pick up a cup, needs to be carefully controlled by our brain. The project conducted by Cathy Craig, funded through her ERC Starting Grant (2007), is about understanding how the brain controls the timing of our movements so that we can improve movement performance. By carrying out basic experimental research in psychology, the research team has shown how specific patterns of visual and auditory information influence how and when we act. Together with engineers, they have created audio and visual based sensory guides that provide timing signals to increase movement performance in different groups of people.

The researchers have looked at how sensory guides can improve balance in older adults and walking in people with Parkinson's disease. With the advent of new gaming technology that uses movement as the game controller, the team has used this technology (e.g. the Nintendo Wii balance platform) to create its own bespoke audio-visual balance training games. The latest results have shown significant progress in functional balance in older adults (>65 years) after playing these games for four weeks. These findings have major implications on/for falls prevention programmes and general healthier active older lives (see BBC report: http://www.bbc.co.uk/news/uk-northern-ireland-14484516).

To enhance movement performance in sport for instance, Cathy Craig's team has also developed a golf putting device that presents patterns of moving lights and sounds as a template for how the person should move. Sound has often been neglected in sports training, but has proved to be a very powerful way of improving the consistency and timing of a movement. Other research in the field of sport has involved state-of-the-art immersive, interactive virtual reality technology to examine how elite and novice players (in rugby and football) time their actions when confronted with different game scenarios (e.g. curved free kicks in football, side-steps in rugby).

Visitors to the Innovation Convention's exhibition stand are welcome to try the audio-visual putting aid first hand, as well as the bespoke balance training games for themselves. Videos will also be shown at the stand.

ERC grantee: Cathy Craig

Host institution: Queen's University Belfast, Ireland

ERC project: Temporal Enhancement of Motor Performance Using Sensory Guides (TEMPUS_G)

ERC call: Starting Grant 2007

ERC funding: € 860,924

More information on: http://www.qub.ac.uk/research-centres/ PerceptionActionResearchLab/ Projects/

Meet Cathy Craig on stand no. 7 under the "Longer and Healthier" exhibition section.

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