Project aims to develop environmentally friendly, energy-autonomous wireless microsensors

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A team of researchers from the UPNA-Public University of Navarre is leading the ENEIDA project, due to end this year and which aims to tackle the technological changes needed to create more energy-efficient and more environmentally-friendly electronic devices. "The networks of wireless sensors are its main application," points out head researcher Antonio López-Martín,"but the results can be extrapolated to spheres like mobile telephony, WiFi systems, Bluetooth terminals and, in general, to all the cell- or battery-powered devices in which duration is a critical aspect; for example, pacemakers or implantable defibrillators, where battery replacement requires surgery". The results have been published in various scientific journals like the *International Journal of Circuit Theory and Applications*.

Wireless sensor networks comprise sensor nodes and actuators that detect parameters from the environment or individual (temperature, humidity, pressure, heart rate, presence, etc.), implement actions (switching on/off of devices, opening/closing of valves, generation of neuromuscular stimuli, etc.) and communicate with each other and with other networks like the Internet over radio waves, without any need for leads.

The ENEIDA project —development of energy-autonomous wireless microsensors for smart environments with a minimum of Environmental Harm— is being funded by the National Scheme for R+D+i, has a three-

year execution period (2011-2013), and a global budget of 400,000 euros.It consists of two sub-projects, one being run by the UPNA and the other by the University of Seville.Furthermore, each of these universities has various supporting organisations:in the case of the UPNA, the companies AccionaEnergía, Azkoyen, Tesa, IngenieríaDomótica, ProyectosTecnológicos de Navarra, i3i Ingenieros, TafcoMetawireless and Osés RFID. The subproject being run by the University of Seville has the support of Telvent, AT4wireless, MP, GrupoAzvi and ADevice.

ENEIDA comes within the framework of so-called sustainable communications. It sets out to mitigate the huge energy and environmental impact of current telecommunications systems with their electronic components, cells and batteries, the recycling of which is very complex. To address this, the researchers are working to develop devices with ultra-low energy consumption (smaller, longer-lasting batteries) and with high integration density (so that the device can be integrated into the lowest possible number of chips, even in just one). One of these chips, which only has a part of what a microsensor needs, would fill 15 times less than the area of a pinhead.A fully integrated microsensor would occupy approximately twice the space of a pinhead (excluding housing and power supply).

Excellent results

The project has a multidisciplinary approach with four main lines of work. Firstly, the above-mentioned ultra-low consumption and high integration density communications hardware.Secondly, the development of efficient techniques for environmental energy harvesting. "To achieve this," explains UPNA Professor Antonio López, "we are working on microelectronics systems capable of efficiently harvesting and managing the energy available in the environment (solar, thermal, mechanical, radiofrequency, etc.)to produce communications systems that don't need

replaceable batteries and which are therefore energy autonomous. "Thirdly, integrated microsystems are being produced and they allow environmental parameters to be captured with minimum energy consumption. And finally, work is being done on 3D simulation software for radioelectric propagation, "Through this software it is possible to choose the optimum location, from the radioelectric perspective of the communications devices;that minimizes the power needed in transmission and the interference that some devices produce in others. This enables great energy savings to be made in situations where the location of the devices can be chosen."

According to Antonio López, "the project is producing excellent results, some of which were not initially anticipated. "So over 20 designs for integrated circuits have been developed and their results have been published in 23 articles in international journals and 31 papers at international conferences. Some of the developments have been transferred to the Japanese multinational Seiko Epson by means of four applications for international patents. The technology developed was also used in the UPNA project which last year received the 12thTalgo Award for technological innovation; it set out to provide a railway ecosystem with intelligence by means of ultra-low consumption wireless sensor networks which are powered, wherever possible, by harvesting the environmental energy available in the carriages.

More information: Lopez-Martin, A. et al. Power-Efficient Analog Design Based on the Class AB Super Source Follower. *International Journal of Circuit Theory and Applications* 40, 11: 1143-1163. 2012. onlinelibrary.wiley.com/doi/10 … 002/cta.776/abstract

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