Press release
Nota de prensa

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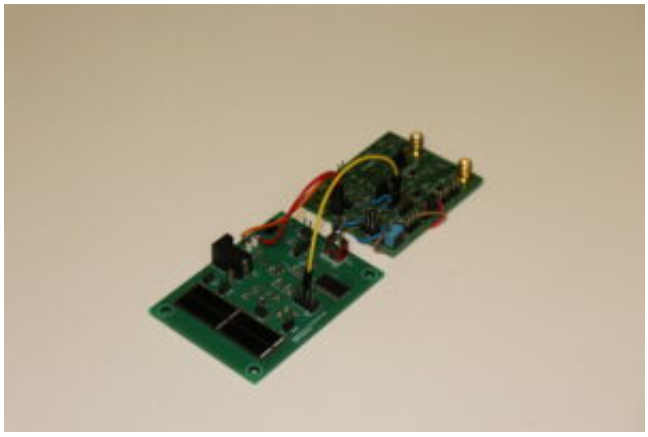
Wireless communication devices without batteries? Research and sustainability, united through light

A team of researchers, led by Domenico Giustiniano, Research Associate Professor at IMDEA Networks Institute, Madrid, has presented important advances in the creation of sustainable wireless communication systems. This represents a new step towards making battery-free devices a reality, through the convergence of two emerging technologies: **LiFi and radio frequency (RF) backscatter**. Potential applications include smart homes, smart cities, and smart agriculture.

It is expected that more than 64 billion IoT devices will be deployed by 2025, and they will work with batteries. The chemical components of these batteries threaten to have a huge environmental impact on the Earth. There is a **pressing need to find a solution for removing the batteries** without affecting communication performance and IoT services.

IMDEA researchers propose that **IoT devices will operate with the energy provided by Light Emitting Diodes (LEDs)** and any other light source, and data provided by modulating these LEDs, a concept called LiFi, and that IoT devices will send data back by reflecting and modulating the RF coming signals already present in the environment, a passive and low-energy transmission technique called RF backscatter.

"**Our work opens the door to long-range, battery-free Internet of Things applications** retrofitting lighting infrastructure for communication, something that was not previously possible to achieve. It's the result of three years of research; when we started, LiFi technology and RF backscattering were considered independent technologies, and we have shown that LiFi can solve the limitations of RF backscatter, and that LiFi can be applied to a new field, battery-free communication" says Dr. Giustiniano. The IMDEA Networks team (formed by Domenico Giustiniano, Borja Genovés Guzmán, and Muhammad Sarmad Mir) has enjoyed the collaboration of Dr. Ambuj Varshney (Uppsala University, and soon to be Assistant Professor at the National University of Singapore).



"Solar cells have been widely used to harvest energy. In this work, we go a step further and demonstrate that they can be used efficiently and simultaneously as both a source of power harvesting and as a communications receiver. **Our solution solves the trade-off between the captured energy required by the IoT device and the desired data rate**, allowing our system to operate without using batteries," says Borja Genovés Guzmán, Post-Doc Researcher at IMDEA Networks and one of the co-authors of the scientific paper.

The research (PassiveLiFi: Rethinking LiFi for Low-Power and Long Range RF Backscatter), which has demonstrated that power-constrained IoT devices can reach very long-range transmission without affecting their power consumption, will be presented at the prestigious international conference ACM MobiCom 2021. Representing a transfer of technological knowledge to society and supported by funds of the Community of Madrid, Spanish Ministry of Science and Innovation, and the European Union, the research has been recently presented to the general public at events such as Science and Innovation Week and the European Researchers' Night (organized in the Community of Madrid by the madri+d Foundation for Knowledge).

About Domenico Giustiniano

As Research Associate Professor at IMDEA Networks, he leads the Pervasive Wireless System Group and continues to participate in European-funded projects such as ENLIGHT'EM, SOMIRO, and LOCUS. He holds a PhD in Telecommunications Engineering from Rome Tor Vergata University (2008), and, prior to IMDEA Networks, he was a researcher in top labs such as Telefonica Research, Disney Research, and ETH Zurich.

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About us

IMDEA Networks Institute, promoted by the Regional Government of Madrid, is a research organization on computer and communication networks whose multinational team is engaged in cutting-edge fundamental science and technology. As a growing, English speaking institute located in Madrid, Spain, IMDEA Networks offers a unique opportunity for pioneering scientists to develop their ideas. IMDEA Networks has established itself internationally at the forefront in the **development of future network principles and technologies**. Our team of highly-reputed researchers is designing and creating today the

networks of tomorrow.

Some keywords that define us: 5G, Big Data, blockchains and distributed ledgers, cloud computing, content delivery networks, data analytics, energy-efficient networks, fog and edge computing, indoor positioning, Internet of Things (IoT), machine learning, millimeter-wave communication, mobile computing, network economics, network measurements, network security, networked systems, network protocols and algorithms, network virtualization (software defined networks – SDN and network function virtualization – NFV), privacy, social networks, underwater networks, vehicular networks, wireless networks and more…

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