

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

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Muhammad Sarmad Mir, PhD Student at IMDEA Networks and one of the authors. Credit: IMDEA Networks Institute

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 which has demonstrated that power-constrained IoT devices can reach very long-range

transmission without affecting their power consumption, will be presented at the 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).

More information: Research:

dspace.networks.imdea.org/handle/20.500.12761/1541

Conference: www.sigmobile.org/mobicom/2021/

Provided by IMDEA Networks Institute

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