Resum de Tesi Doctoral

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Escola de Doctorat

DNI/NIE/Passaport	46984095V
Nom i cognoms	Raül Gómez Cid-Fuentes
Títol de la tesi	Enabling the Internet of Things through Energy Harvesting: A circuit-aware system synthesis-oriented analysis approach
Unitat estructural	Departament d'Enginyeria Electrònica
Programa	Doctorat en Enginyeria Electrònica
Codis UNESCO	332505 / 330711 / 332204 /

(Mínim 1 i màxim 4, podeu veure els codis a http://doctorat.upc.edu/gestio-academica/impresos/tesi-matricula-i-diposit/codis-unesco)

Resum de la tesi de 4000 caràcters màxim (si supera els 4000 es tallarà automàticament)

Powering wireless sensors has become a key challenge to enable the Internet of Things vision. A common approach to achieve this is to use Energy Harvesting. By means of this technology, sensors have access to an unlimited source of energy, which can extend their operation lifetime.

Unfortunately, typically the energy that is available surrounding the sensors is neither controllable nor predictable, showing significant variations in the expected harvested energy in terms of both space and time. This can cause the temporal disconnection of parts of the wireless network.

The objective of this thesis is to mitigate the undesirable effects of the spatio-temporal variations of the surrounding energy, by following a two-fold approach: first, to provide a high level understanding of the involved trade-offs in the design of a wireless sensor and the interconnecting network. Then, to synthesize an energy field to guarantee the required amount of ambient energy at the surrounding of the considered nodes.

The first part of the thesis starts by presenting a formal description of the environment. The derived energy model is first used to answer fundamental questions on throughput scaling and, then, to provide design guidelines for energy harvesting sensors. It is found that energy harvesting is a scalable solution to power and recharge IoT sensors, which require additional circuit design to guarantee their operation in energy scarce scenarios.

On the second part of this work, wireless RF power transmission from controllable Energy Transmitters (ETs) is considered as a feasible approach to synthesize an energy field to power sensors at-a-distance, hence tackling the lack of available ambient energy in spatial regions, at the cost of occupying the available wireless spectrum. Due to the limited transmission range of this approach, the use of multiple ETs to cover entire areas is required. We first discuss on the feasibility of synthesizing energy fields with multiple ETs. We show that powering those sensors with multiple ETs stands as a scalable approach, which presents a trade-off between the channel conditions and the energy multiplexing design complexity. We, then, present an opportunistic scheme to leverage the generated interferences of multiple ETs. Finally, we propose a joint energy and communication method to circumvent the imposed trade-offs of in-band multi-ET wireless RF power transmission.

Overall, we find that the analysis and design of wireless networked sensing systems, enabled by energy harvesting, and the development of novel wireless RF power transmissions schemes will play a key role in the future development of autonomous IoT deployments.

Lloc: Barcelona

Data: 19/05/2016

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