Defense Announcement

RF ENERGY HARVESTING AND INFORMATION TRANSFER IMPLEMENTATION IN THE IoT

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With the growing number of connected devices (e.g. smartphones, sensors, actuators and cameras) in the fifth generation (5G) of mobile technology, the massive Internet of Things (IoT) is expected to address a wide range of characteristics and demands, with more radio frequency (RF) bands to support multiple frequency transmission by 2020. Therefore, a growing interest has recently emerged by researchers in wireless communications to develop wireless energy transfer and harvesting solutions for 5G networks, more specifically in RF energy harvesting. RF energy harvesting is the process by which radiative electro-magnetic waves are captured, converted, stored and used to operate usually low-energy consumption devices ranging from wearable electronics to sensor networks. The variety of settings in which energy harvesting and transfer technologies can be adopted, e.g., wireless sensor networks, mobile ad hoc networks, delay tolerant networks, smart cities and so on, is certainly noteworthy. The identification of novel network architectures, protocols and algorithms to integrate energy harvesting solutions in wireless communications networks is paramount to guarantee their effectiveness. This dissertation aim to address the use or RF energy harvesting and data transfer in IoT devices of the 5G networks. It is of two-fold. Firstly, the thesis aims to demonstrate the feasibility to supply endless and uninterrupted energy to low-power wireless sensor networks - whether they are from a dedicated source or not - by designing real hardware prototypes and conducting experiments. Secondly, it proposes several mathematical optimization algorithms to integrate energy harvesting and data transfer in IoT devices in general under different scenarios. Some of the proposed algorithms are designed to carefully select the device, while others enable devices to cognitively select a wireless channel from within the 5G spectrum to harvest energy and transfer reliable and uninterrupted data to an access point.