Ultra-Low-Power Integrated Circuits Enabling Next-Generation IoT Applications

Prof. Patrick Mercier

PI, Energy-Efficient Microsystems Lab
Co-Director, Center for Wearable Sensors
University of California, San Diego

Many emerging applications in wearable sensors, smart homes, unattended ground sensor networks, and other Internet-of-Things (IoT) devices measure signals such as human physiochemistry, ambient temperature, human body movement and more – many of which are signals that do not tend to vary rapidly with time. Exploiting these low signal bandwidths at individual device level enables the design of integrated electronics that can capture this data at unprecedented low power levels – think nanowatts to microwatts – which helps to enable entirely new applications and form factors due to reduced battery size and/or inclusion of small energy harvesters. This presentation will begin by introducing some of these sensor front-ends, and where the field is going moving forward. However, there is still an elephant in the room: wireless communications. It is not currently possible to communicate over pragmatic distances at such low power levels using conventional standards-compliant radios. This presentation will discuss why these limitations exist, and what techniques at the circuit and system level can be deployed in next-generation 5G networks to reduce power consumption without major sacrifices to reliable operation in congested environments.