

Delivering Electrical Power to Distributed MEMS Sensors for Battery-free Operation

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Networked, wirelessly connected chemical and physical sensor development is an active area of research. Although MEMS sensors consumes very little power, efficiently delivering electrical power to distributed sensors in a network can be a challenge. At present imbedded batteries or solar power are used as power sources. In many cases, sensors are physically wired for delivering electrical power. This creates a major challenge when the number of sensors needed is very large and they are spread over an area. We have developed a new approach that does not depend on EM radiation or magnetic coupling for electricity transmission. This approach of delivering electrical power using standing waves over a single conductor (surfaces) eliminates the need for imbedded batteries for sensors and wearable appliances. Using this approach, it is possible to power large surfaces that include inexpensive foils, metal furniture, human bodies, robotic chassis, surfaces painted with conducting paint, etc. We envision future surfaces to include prosthetic devices, combat suits, home interiors, vehicles, aircrafts, industrial pipelines, and processing plants to name a few. Since the power delivery is based on single wire, there is no radiation and the technique is very safe as the current and voltage are out of phase on the surface (reactive power). This method has efficiency over 95% which can be improved even further. Such a wireless surface can address the dilemma of the trillion-battery problem envisioned with the near-term, predicted use of over a trillion IoT devices as it will obviate the need for batteries. Also, communication with the devices can be accomplished by superimposing the communication signals on the power with a different frequency. In this lecture I will present our recent results of powering multiple sensors using single wire (surface), single contact, no-return method of electrical power delivery and address the question of how such a surface power can make the digital technologies, such as the IoTs very successful.