SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

Self Capacitance Based Wireless Power Transfer for Wearable Electronics: Theory and Implementation

PhD Dissertation Defense

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Abstract: Wireless power transfer (WPT) is a technology of transmitting power through different mediums to electronic devices that can be wearable or implantable for the purpose of energy harvesting. Conventionally, there are four standard types of WPT: Radio Frequency (RF), Magnetic Induction (Ind), Ultrasound (US), and Capacitive Coupling. Some of these are remotely delivered, others are locally. Conventional WPT approaches work on the principle of mutual coupling where the return paths for the source current and the load current are separate. As a result of that, the power transfer efficiency (PTE) of these approaches scales non-linearly with cross-sectional area of the transducers and the relative distance and respective alignment between the transducers. In this work, we have invested the special properties of the self-capacitance of any electrically isolated body to deliver the power wirelessly to wearable or surface mounted electronics. Self-capacitance based wireless power transfer is a technique that converts electrostatic energy into DC voltage, which has been used here for delivering the power over the human body surface to wearable electronic devices. The main goals of the design are to achieve the high-power transfer efficiency (PTE) and deliver the power to the mm-sized electronics over a comparable long delivery distance. Self-capacitance based wireless power transfer has not been explored before, which uses floating electrodes for both power source and receiver to construct a hypothetical external ground that serves as the return path for the displacement current. We showed that the SC-based WPT technology can be extended to provide the necessary energy to numerous low power wirelessly connected mm-sized nodes as needed for the next generation of the Internet of Things (IOT); specifically on the human body for the purpose of wireless health monitoring and/or fitness tracking such as in smart rooms application. The work also includes the design and implementation of power efficient wearable electronics (sensors and wireless receivers) using a common reference circuit called Proportional-To-Absolute-Temperature (PTAT) circuit.

Date: Tuesday, March 31, 2020
Time: 2:00 p.m.
Location: https://wustl.zoom.us/j/7225094209
Meeting ID: 722 509 4209

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