VLC-backscatter Design for Self-charging indoor IoT Devices

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Connecting billions of the IoT devices to the Internet faces many challenges as the IoT devices have to be battery-less or self-powered, these small IoT devices need to be localized and tracked, these devices compete for the wireless spectrum, they might need specialized infrastructure, and the wireless RF signals might not be available all of the time.

We believe that FSO and specially VLC provide a good solution to the above challenges. Our preliminary investigation reveals that we can use VLC Backscattering to resolve this problem. We recommend research in the following areas: (1) Studying different energy efficient device-level implementation of VLC and VLC backscatter. Different technologies can be studied and compared, such as modulating retroreflectors, Multiple Quantum Wells, and MEMS. (2) Designing and comparing different VLC and VLC-backscatter based localization and orientation specification approaches ranging from signal intensity approaches to angular ones. Our preliminary experiments show that we can achieve 1-2 cm level localization accuracy. (3) Designing new MAC layer algorithms for VLC and VLC backscatter as they create new opportunities with regard to the MAC-layer due to their directionality. (4) Developing new modulation schemes that allow full-duplex links based on the new paradigm while satisfying the illumination conditions. (5) Studying joint energy harvesting and transmission scheduling algorithms based on the new paradigm.