

## Low-Cost Wireless Power Transfer System for Smart Recycling Containers

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**Abstract :** As innovation progresses, more possibilities are made available to increase the efficiency and reach of solutions for Smart Cities, most of which require the data provided by the Internet of Things (IoT) devices and may even have higher power requirements such as motors or actuators. A reliable power supply with the lowest maintenance is a requirement for the success of these solutions in the long term. Energy harvesting, mainly solar, becomes the solution of choice in most cases, but only if there is enough power to be harvested, which may depend on the device location (e.g., outdoors vs. indoor). This is the case of Smart Waste Containers with compaction systems, which have moderately high-power requirements, and may be installed in places with little sunlight for solar generation. It should be noted that waste is unloaded from the containers with cranes, so sudden and irregular movements may happen, making wired power unviable. In these cases, a wireless power supply may be a great alternative. This paper proposes a cost-effective two coil resonant wireless power transfer (WPT) system and describes its implementation, which has been carried out within an R&D project and validated in real settings with smart containers. Experimental results prove that the developed system achieves wireless power transmission up to 35W in the range of 5 cm to 1 m with a peak efficiency of 78%. The circuit is operated at relatively low resonant frequencies, which combined with enough wire-to-wire separation between the coil windings, reduce the losses caused by the proximity effect and, therefore, allow the use of common stranded wire instead of Litz wire, this without reducing the efficiency significantly. All these design considerations led to a final system that achieves a high efficiency for the desired charging range, simplifying the energy supply for Smart Containers as well as other devices that may benefit from a cost-effective wireless charging system.

**Keywords :** electromagnetic coupling, resonant wireless charging, smart recycling containers, wireless power transfer

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