Simultaneous Wireless Power/Data Transfer for Electric Vehicle Charging

Introduction:
Inductive power transfer (IPT) system is designed to deliver power efficiently from a stationary primary source to one or more movable pickup units over an air gap via magnetic coupling. As many industrial and domestic applications require power transformation without physical contacts, the IPT technology is gaining global popularity and wide acceptance for numerous applications over wide power ranges.

The typical IPT technologies include induction cooking, contact-less battery charging for electric vehicles, bidirectional IPT vehicle-to-grid systems, mobile phones charging, medical implants, dynamic charging on roadway applications, avionic applications, power and data transfer and some special applications. Among the recent publications, the excellent survey presents wireless power transfer across diverse applications using IPT and the capacitive power transfer technology by comparing the two approaches in power level, gap distance, operational frequency, and efficiency.

Existing system:
The power line communication (PLC) technology is digital data transfer in power line network. At present, this commercial application has been applied in home automation. However, PLC cannot work through a power meter and a transformer. Therefore, the IPT system is not suitable to use the PLC technology in communication, because the IPT system works
like a loosely coupled transformer. The RF technologies such as bluetooth, RF modulation, wi-fi, etc., are popular. However, when working, these mechanisms need an IP address matching process between server and user.

Dis-advantages:
- The system includes two operational frequencies that may result in relatively higher cost in the product.

Proposed system:
A wireless vehicle charger with the capacity of simultaneous data/power transmission is proposed. The grid (primary) side is operated on the utility power source of single phase. The vehicle (secondary) side is to accept the power transferred from the primary side. In addition to receiving power, the secondary side will simultaneously transfer digitalized date back to the primary side via the same conduction coils.

To depict the idea, consider the simplified schematic diagram of the proposed system. First, the ac grid voltage is rectified via a rectifier at the primary side, in which, a fly back converter, tuned to the operating frequency of power transfer is used. \( Q_1 \) at the primary side has optimal efficiency to deliver power based on the principle of zvs. \( Q_2 \) at the secondary side has two functions, i.e., control of output current and transmit the modulated signal. At the primary unit, the parameter tuning of the \( lc \) circuit is essential. Although such tuning depends on the load, it is not necessary to adapt the resonant system because the coupling factor is low.
Advantages:
- Achieve steady-state compensation.
- Improves the security during energy charge.

Applications:
- Grid applications.
- EV Charging.

Block Diagram: