Development of a Novel 3.3kW High Efficient Wired/Wireless EV Charger

The uses of electric vehicles (EVs) for transport in the automotive industry has increased as these are environmentally friendly (low greenhouse gas emissions and low fuel consumption). In spite of many advantages associated with EVs, efficient utilization of energy storage system in EVs for an appropriate driving range has been facing many problems since the storage elements (batteries) are heavy, bulky, have less life-time and need more charging time. The EVs are generally charged through the cable connected to the alternating current (AC) source, these are called as conventional plug-in chargers. The conventional chargers consist of four conversion stages to regulate the battery charging current and to make batteries isolated from the source. The conventional system schematic diagram is shown in Fig. 1.

The conventional charging system requires AC-DC rectifier with appropriate power factor correction circuit at the grid side and the DC power will be converted into a high frequency AC to reduce the isolation cost of the isolation transformer cost. However, to reduce the number of conversion stages in the system an direct AC – AC converters (i.e., Matrix Converter) are proposed in various literatures. The convention single phase matrix converter uses eight switches, which causes the increase in system volume and cost. The proposed project aims to develop a novel highly efficient direct AC-AC converter with reduced number of switches compared to conventional two stage converters and matrix converter.

The plug-in charging method needs large installation of charging stations, with charging sockets/ plug and cable can be easily damaged, stolen. Besides, electric safety is of major concern: electric shock due to rain, etc. which cause tripping hazards. In this context, the revolution in technology has brought solution such as inductive wireless power transfer (IWPT) technology. The conventional inductive wireless power transfer system will consist of the converters as shown in Fig. 1. However, the WPT system also demands the high frequency power source for effective power transfer and better efficiency. Hence, the proposed system configuration with improved efficiency can also be used for wireless battery charging applications.

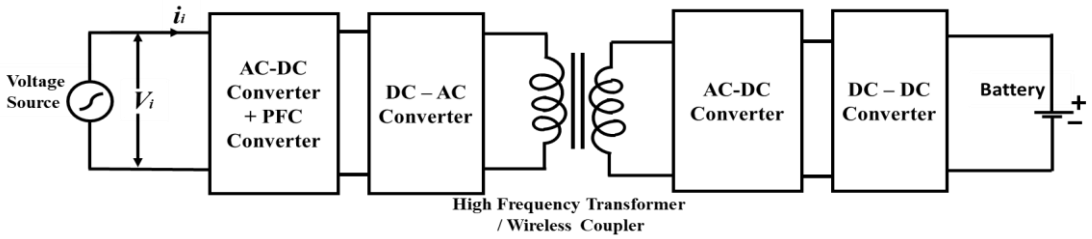

Fig. 1. Conventional plug-in/wireless battery charger.

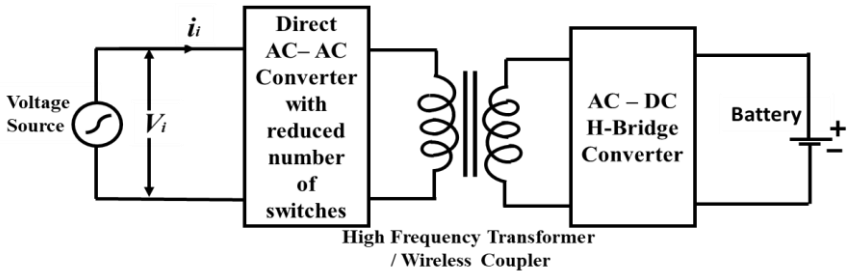

Fig. 2. Proposed System configuration for plug-in/wireless battery charging.

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