



Developing a Wireless Power Transfer System with Dynamic Charging for Electric Vehicles

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Abstract: In modernizing electric vehicle chargers, the next step is more convenient by using cable cables by linking electric vehicles with chargers to wirelessly load the electric vehicle. This is an innovation technology that can be used with all electric vehicles (EVs) to help eliminate user participation. A key obstacle to the acquisition of the wireless charging process is ground clearance, which downgrades the efficiency of power transmission. Various terrestrial clearance WPT theory is informed and the corresponding wireless chargers are analyzed. Cable-free chargers are shown as the ability to distribute outputs of approximately 45 V over 20 cm. The battery is 4.5 kWh and the supercapacitor (SC) is 3.8 kWh, which is sufficient to load an electric vehicle.

Keywords – Electric vehicle, Wireless charging, WPT, Supercapacitor

1. Introduction

Wireless and Induction Load Electric Vehicles (EVs) are new types of EVs that charge batteries from afar using wireless charging technology. In contrast to traditional plug-in-EVs, EVs in the wireless charging process do not require a power cable connection to load the EV in the wireless charging process as a static or dynamic charging EV. One of the first electric vehicles with a fixed shop was a typical engine-EV, with the primary converter being a paddle and a secondary converter for the vehicle charging device. The topology of the charging system has been introduced. The inpatient load process transfers energy more efficiently than dynamic charging due to better alignment between transducer.

The electric vehicle (EV) retail market must gradually grow. To revive the vehicle within a short period of time, a high-power charging or

charging station is required from existing conductive loading methods. Additional inconveniences are caused by incompatible plug containers between different EV models. Charging infrastructure can be shared across a variety of EV models, including wireless charging technology. With 85 million self-driving cars expected to be used until 2035, wireless load establishment is required to include them in such vehicles. The advantage of dynamic shops is that many people can use smaller, lighter batteries to frequently charge using stream rails under the streets. None of these studies were analyzed by how the amount of battery size could be reduced and how the cost reduction in battery size was reduced.

The location of the proposed system of the EV. The current chargers of EVs are connected primarily at home, at work or at a central charging station. However, integrated chargers are

inconvenient and easily electrically leak-prone. Wireless loads are based on WPT technology (WLAN power transfer) to make EV usage more convenient and safer. There are two categories of wireless cargo: static wireless and dynamic wireless cargo. The system requires that the electric vehicle be parked at the transmitter when loaded in the direction to get electricity from the transmitter. However, battery capacity and energy density limit development. With DWC systems, the EVS can be charged while on the move. Therefore, the EV can move longer, the battery capacity and weight will be reduced, and transportation efficiency will be improved. Therefore, research and development of DWC systems can facilitate future EV development. However, EV movement creates many challenges for design and control systems.

The design of magnetic couplers is considered to be one of the most important factors in the system. In DWC systems, the magnetic components are usually made up of a transmitter track located under the street and a recipient coil assembled under the EV. Transmitter tracks in the system can be divided into two main types: long distance or short track transmitters. The long track transmitter structure has a high inductance, a low coupling coefficient, and a low resonance frequency. These transmitter tracks are less efficient and have higher electromagnetic interference. Short tracks to reduce EMI and increase efficiency [8]. All short track transmitters are the same size on SWC. Transmitter tracks are formed by placing several short track channels together. Each station coil has a separate compensation circuit, making it extremely flexible to design and expand the transmitter line.

The length of the recipient is optimized for three phase dynamic systems with two recorded images with reduced output power variation. The proposed solution for reducing the pulsation of output power by inserting a transmitter coil has optimized simulations. These papers optimize the size of the transmitter and receiver to reduce

pulsation performance. However, the findings are only performed if the EV is moved in a straight direction. No coupling coefficient characteristics have been reported according to the position where the EV is moving in the wrong direction. This is an important feature of system design and control. Furthermore, the design of the compensation circuit does not taken into account the impedance matching problem, making it difficult to obtain maximum efficiency.

The resonance frequency is independent of the range of load impedance and soft switching conditions as well as the coupling coefficient. These features of the compensation cycle are similar to compensation groups. However, for the same structural performance, the size of the elements in the compensation circuit is smaller than the compensation group. This is practically important in designing high performance systems. In the reward circuit, a dynamic wireless charging process was designed, in which the primary compensation induction is twice as large as the inductance of the secondary compensation. As a result, transmission efficiency does not reach the maximum value at the design point. This article proposed a method for calculating compensation circuit parameters according to the optimum load value to maximize transmission efficiency. If the load impedance always holds the optimum load value, transmission efficiency reaches its maximum value over a wide frequency range. Additionally, frequency can be checked to improve inverter efficiency, such as persecution of phase angle tracking. A dynamic charging system prototype has been built with an output of 1.5 kW. The average efficiency of dynamic store is 89.5%. Output power variation.

The design and manufacturing of 1 MW systems for induction power transmission (IPT) that delivers the vehicle in real time without battery charging is a high-speed train [9]. The IPT system consists of four pickups including a 1 mW resonance inverter, a 128 m station, a rectifier, and a wireless feedback network that maintains a

constant output voltage of the pickup. The system's system frequency is 60 kHz, providing efficient power transfer with a large air gap. The measurement efficiency of the IPT system at 818 kW output power of 5 cm air gap pickup is 82.7%. The electromagnetic field and induced voltage on the rails are also measured for safety assessment. The manufactured IPT system is adapted to high speed trains, and after starting the process, the train will normally accelerate to a speed of 10 km/h.

It passed a capacitively coupled wireless charging system near the field, consisting of a cargo dock resonator and a receiving multiband resonator [10]. The transmission dock resonator includes planar strips and ring-shaped metal plates to supply multiple folded strips than the Gigahertz band reception 3D multiband resonator. Wireless charging systems for mobile handsets are determined to experimentally verify the use of compact, highly efficient captured wireless charging systems.

A driving the PA with minimal hardware overhead. The control of the Class-D PA's output voltage at the fundamental tone is proved to be linear [11]. Using a $\Sigma\Delta$ modulator, a WPT system is designed with a fast control loop for the voltage regulation of the receiver at the secondary coil. A transmitter chip and a receiver chip are fabricated using the AMS 0.35- μm CMOS process. The $\Sigma\Delta$ modulator is implemented in a field-programmable gate array. The measurement results show that, with the proposed $\Sigma\Delta$ modulator, the tuning range of the receiver output voltage could be improved by 50% compared with the conventional one. The load transient response time is only 10 μs .

Most existing solutions for wireless power transmission (WPT) are restricted to two-dimensional (2-D) configurations that limit mobility when loading electronic devices [12]. What you need is a system that can supply a large amount of power anywhere. Previous studies on

quasi-stat cavity resonance (QSCR) have shown promising results for WPT that are ubiquitous above the room scale. However, QSCR has many challenges, such as the need for managers in the middle of the room and performance efficiency. This is not high throughout the cavity. To tackle these two editions, this character provides a spatial scale department with a PI mode (Pole Independent) which can be operated without poles. In finite element simulations, it has been shown that the only use of PI mode can be provided with efficiency of over 50% to 93% of a volume of 54 m³. Furthermore, the Pi mode and pole-dependent (PD) modes used in previous QSCRs can coexist in the same resonator.

Wireless Power Transmissions (WPTs) have attracted a lot of attention on battery buses in electric vehicles (EVs) [13]. Resonant WPT systems play a key role in achieving efficient power transmitters from source to load. A summary of the two-factor resonance compensation technology and its properties under different operating conditions is provided. Additionally, the converter and control strategies used for various topologies are checked. Performance factors behavior is evaluated based on operating conditions and compared for different topologies.

2. Proposed System

Four resonance cycles - topology can be used in WPT systems (WLAN current transmission). After the capacitors were inserted on both sides, their indexing took place. Assume that the connection can be parallel or in series with the coil. The topology is Series Series (SS), Series Parallel (SP), Parallel Series (PS), and Parallel Parallel (PP). The first and second inductances and capacitor values (L_1 , L_2) and (C_1 , C_2) are determined for filter administration. Use primary and secondary circuits of couplers, inductance, or capacitance to improve power transmission, minimize the apparent performance of the input source, and ensure active performance

transmission to loads. The authors have demonstrated by examining these topologies and displaying several actual prototypes. The latest trends initialize wireless power movement to

attract more attention. The block diagram includes grids, rectifiers, inverters, LC filters, linear transformers, supercapacitors and batteries.

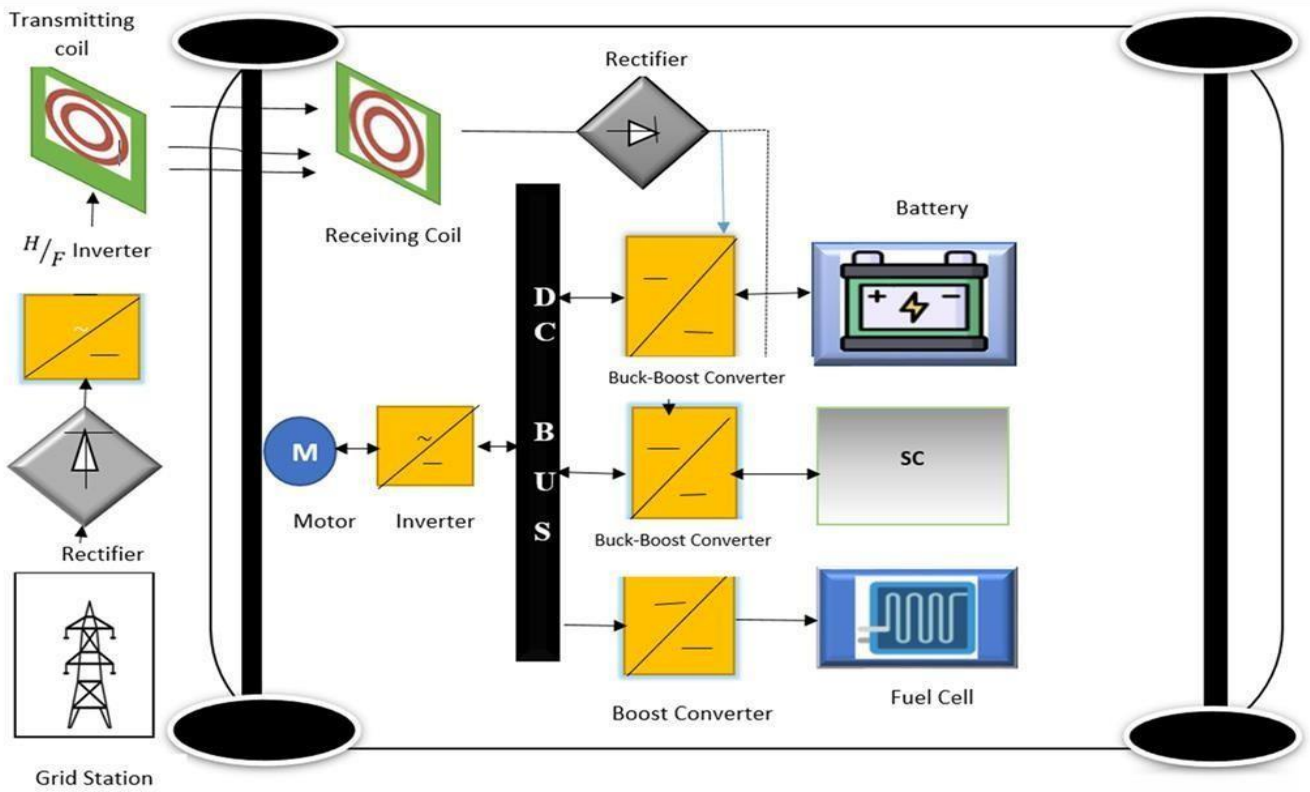


Figure 1: Proposed block diagram for a wireless power transfer for EV

A low-frequency change power supply is delivered, corrected, and inverted to a high-frequency change power supply. LC filters are used to drive away harmonious things. A high-frequency change power supply is provided to the transmitter coil, the EMF is directed to the recipient coil, and the EMF is redesigned by the AC. DC power is used by the Super Condenser to charge the EV battery. This system uses a control system to adjust the transmitter coils of the various types of EVs themselves. Control systems, induction filters, and saws aspirate signals to get the desired output.

The principle used in this project is the Faraday method of electromagnetic induction. According to Faraday's principle of electromagnetic induction, the induced EMF has a recipient coil. Due to the magnetic field, the variation of clutch factor K is $k=M/L_1L_2$.

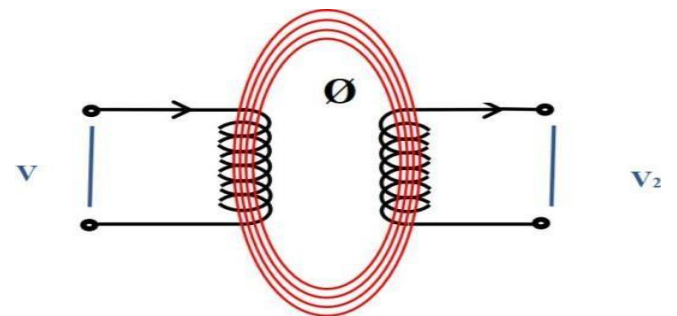


Figure 2: Overview diagram of mutual inductance

Here, coils 1 and 2 are brought close to the magnetic field, attracting the use of two dots to each other, leading to the creation of tension. This will change or affect the I-Strom & V (voltage) of COIL2. This is called mutual inductance.

$$N_2\Phi_{21} \propto I_1N_2\Phi_{21} = M_{21} \quad (1)$$

The constant of proportionality is called as mutual inductance. It can be written as

$$\varepsilon M = N2\phi21 \quad (2)$$

Table 1: SI unit of inductance

Parameter	Symbol	Value
Minimum battery voltage	VB,m	36V
Maximum battery voltage	VB,M	56V
Coils diameter	D	0.38m
Battery charging current	IB	10A

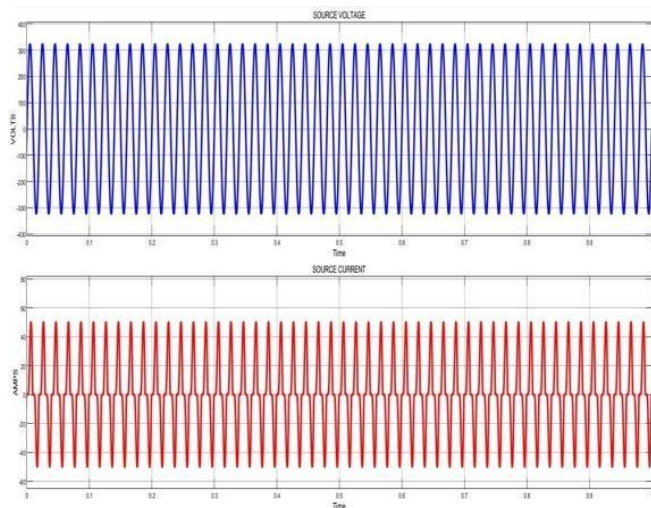
$$\varepsilon_{12} = -N_1 \frac{d\phi_{12}}{dt} N_1 \phi_{12} \propto I_2 N_1 \phi_{12} = M_{21} I_2 \dots \dots \dots (3.3)$$

$$M_{21} = \frac{N_1 \phi_{12}}{I_2} \dots \dots \dots (3.4)$$

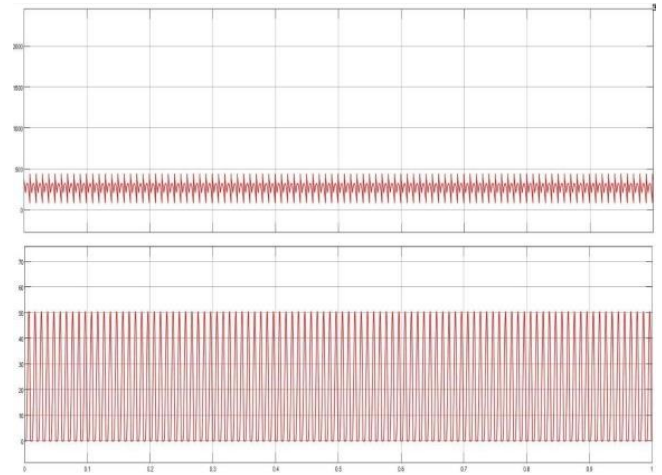
2.1 MATLAB

Matlab stands for Matrix Laboratory. It is a highly technical computing performance language. Integrate calculation, visualization and programming into an easy-to-use environment. In this environment, problems and solutions are represented by familiar mathematical solutions.

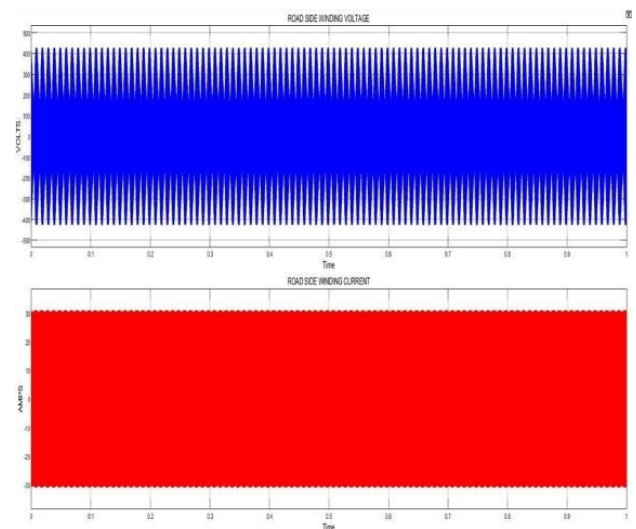
3. Result and Discussion


Figure 3: Input current (current vs time)

In the figure represent the characteristics cure of Source voltage that drawn between the time and current. In the current reaches the peak value in 40A after the peak time the current flows through same.


Figure 4: Output current (current vs time)

The illustrations show the characteristics of electricity drawn between time and electricity. With current, the output current reaches a constant flow after peak time.


Figure 5: Output voltage (voltage vs time)

In the figure, the characteristics represent the healing of the road page and the changing voltages of the road drawn between time and electricity. With current, the peak value after peak time reaches the peak value at 3.5a, and electricity flows constantly.

4. Conclusion

This paper proposed the construction of a wireless power transmission system, including dynamic charging for the use of electric vehicles. Several simulations were performed. Regardless of previous research, we inspected some limitations

on charger placement as part of monitoring areas such as walls and ground clearance. The above supply systems are economical and extremely advantageous as they use inverters, rectifiers and filters to handle different coupling factors. Because it is engraved in a separate control system, the transmitter coil is automatically mapped to transfer the power to the battery based on soil release within 200 mm. After all, this paper contributes to typical obstacles for various ground clearance. The wireless charger was verified with a 4.5 kWh and 3.8 kWh supercapacitor, providing race efficiency for the battery. The maximum simulation results of transmission efficiency reached 94.6%, which corresponds to the analysis.

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