



A Study on Wireless Power Transfer System for Ev Charging

Mr. A.ELANGO VAN¹,

Assistant Professor

Dept. Of Electronics and Communication Engineering

Arunai Engineering College (Autonomous), Tiruvannamalai

suryaelango7@gmail.com

BARATHRAJ J²

Dept. Of Electronics and
Communication

Engineering

Arunai Engineering College

(Autonomous),

Tiruvannamalai

barathrajbadbarath@gmail.com

BASKAR C³

Dept. Of Electronics and
Communication

Engineering

Arunai Engineering College

(Autonomous),

Tiruvannamalai

baskar.c2004@gmail.com

CHARLES L⁴

Dept. Of Electronics and
Communication

Engineering

Arunai Engineering College

(Autonomous),

Tiruvannamalai

charlesbasker2005@gmail.com

How to Cite this Article:

L, C., C, B. & J, B. (2026). A Study on Wireless Power Transfer System for Ev Charging. International Journal of Creative and Open Research in Engineering and Management, <i>02</i>(05).

<https://doi.org/10.55041/ijcope.v2i5.182>

License:

This article is published under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and the source are credited.

© The Author(s). Published by International Journal of Creative and Open Research in Engineering and Management.



<https://doi.org/10.55041/ijcope.v2i5.182>

Abstract

Originating from Nikola Tesla proposed WPT in the late 19th century, with his 1899 "Tesla Tower" experiment being one of the first to attempt to transmit electrical energy through the air using resonance. A Wireless Power Transfer (WPT) system for EV charging is a technology that transfers electrical energy from a power grid to an electric vehicle (EV) battery without physical cables or plugs. It uses magnetic fields—specifically magnetic resonance coupling—between a ground-based transmitter pad and a vehicle-based receiver pad to charge safely and conveniently. RF inverter converts the frequency of the power. Typically, RF inverter also converts the voltage of the power. Considering that the power is $P = VI$ and the impedance is $Z = V/I$, the RF inverter also converts the impedance of the power. The rectifier in Rx side also changes the frequency of the power. Depicts the base components of a WPT system for EV charging. It consists of two prime sub-systems, one of which is existing underneath the road surface and the second is found into the vehicle underbody. The electrification of transportation is underway and wireless charging is poised to play a significant role. Wireless charging systems provide a convenient hands-off method to charge electric vehicles at the same speed and efficiency as standard

conductive AC chargers. More recently, the SAE J2954 standard has established guidelines, allowing for, in some cases, charging efficiencies over 93%.

Keywords: Wireless Power Transfer system (WPT), Solar Power Satellite. Electrification, Voltage and Electric Vehicle.



Introduction

Wireless Power Transfer (WPT) for Electric Vehicles (EVs) is a technology enabling automatic, cable-free battery charging via magnetic resonance, primarily using Inductive Power Transfer (IPT). Originating from Nikola Tesla proposed WPT in the late 19th century, with his 1899 "Tesla Tower" experiment being one of the first to attempt to transmit electrical energy through the air using resonance. While wireless power was used for electronics, modern WPT for transport began gaining traction in the early 2000s with researchers advancing inductive power transfer technology. The first practical application for vehicles appeared in 2002 in Genoa, Italy, with an electric bus project. More recently, the SAE J2954 standard has established guidelines, allowing for, in some cases, charging efficiencies over 93%.

Review of Literature

Fariborz Musavi and Wilson Eberle (2014), In their study, a comprehensive review of existing technological solutions for wireless power transfer used in electric vehicle battery chargers is given. The concept of each solution is thoroughly reviewed and the feasibility is evaluated considering the present limitations in power electronics technology, cost and consumer acceptance. In addition, the challenges and advantages of each technology are discussed. Finally, a thorough comparison is made and a proposed mixed conductive/wireless charging system solution is suggested to solve the inherent existing problems[1]. Nguyen Thi Diep et al, (2020), This paper proposes and demonstrates a wireless power transfer system design for electric vehicle dynamic charging applications. The dynamic wireless charging (DWC) lane is designed for modularly. Each module has three short-track transmitter coils that are placed closely together and connected to a single inverter to reduce the number of inverters. The magnetic coupler design is analysed and optimized by finite element analysis (FEA) to reduce the output power variation during dynamic charging. The LCC

compensation circuit is designed according to the optimal load value to obtain maximum efficiency. The SIC devices are used to improve the efficiency of the high-frequency resonant inverter. A 1.5 kW dynamic charging system prototype is constructed. Experimental results show that the output power variation of 9.5% and the average efficiency of 89.5% are obtained in the moving condition[2]. Vekil Sari (2024), In his study, an inductive coupling WPT system with a series-series compensation topology was designed and implemented for use in EVs. Initially, a 3D Maxwell (ANSYS Electromagnetics Suite 18) model of the system was generated. The impact of individual parameters on the coupling coefficient was analyzed through systematic variations in each parameter's values. As a result, a system with a higher coupling coefficient was obtained. Using this system, three distinct load cases were investigated for their efficiency in the Simplorer (ANSYS Electromagnetics Suite 18) circuit. Subsequently, a prototype of the system was constructed, and the experimental results were compared with the model's results. This study shows that both the output power and the efficiency of the system increase as the load resistance increases. The results obtained in this study are anticipated to offer valuable insights for the enhancement of WPT system design[3]. Abdel Rahman Farghly et al (2025), in their article reveals that has provided a detailed and structured review of wireless charging technologies for electric vehicles, examining system design, compensation mechanisms, and control strategies that influence performance and reliability. The findings demonstrate that the evolution from static to dynamic wireless charging, supported by optimized coil geometries and hybrid compensation topologies such as LCC-LCL and S-LCC, significantly enhances efficiency and power stability under misalignment. Advanced control methodologies—such as passivity-based PI, sliding mode, and model predictive control—have proven effective in stabilizing output voltage and current under rapidly varying coupling conditions. Addressing these



constraints requires continued efforts toward interoperable designs, cost-effective manufacturing, and AI-driven control frameworks. The fusion of intelligent control, bidirectional V2G interaction, and renewable energy integration will be pivotal to realizing seamless, efficient, and autonomous wireless charging systems, ultimately wireless charging stands as a cornerstone technology in the electrification era enabling safer, smarter, and more sustainable transportation networks worldwide[4]. Hany S.E. Mansour et. al. (2026), Their articles exhibits that the developments, alternatives, fundamentals, and benefits of different WPT charging technologies. The economic sustainability of stationary and dynamic wireless charging for EVs is also investigated. Health standards and techniques such as electromagnetic field (EMF) shielding are proposed to deal with safety issues related to human exposure to EMF. To make wireless charging EVs more widely adopted and help developers determine the best design technique to improve the WPT system[5].

Wireless Power Transfer - Meaning

A Wireless Power Transfer (WPT) system for EV charging is a technology that transfers electrical energy from a power grid to an electric vehicle (EV) battery without physical cables or plugs. It uses magnetic fields—specifically magnetic resonance coupling—between a ground-based transmitter pad and a vehicle-based receiver pad to charge safely and conveniently.

Statement of the Problem

Wireless Power Transfer (WPT) for EVs offers convenient, automated, and safe charging by eliminating physical cables, typically using magnetic resonance coupling. Key challenges include lower efficiency due to efficiency loss and misalignment, Electromagnetic Interference (EMI), Thermal Management and Safety, High Cost and Infrastructure Complexity and Lack of Standardization. Solutions involve advanced

auto-alignment systems, resonant circuits, and foreign object detection to maintain efficiency and safety.

Objectives of the Study

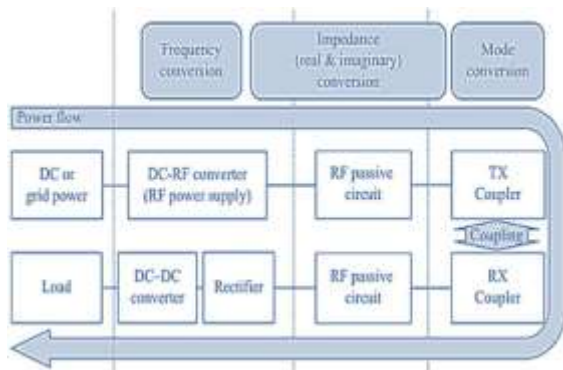
1. To trace the origin and growth of the WPT system for EV charging.
2. To study the components of the WPT system for EV charging.
3. To study the Convenience & Automation, Improved Safety and Reliability, High Efficiency & Power Transfer, Environmental Durability etc.,

Need of wireless Charging system:

1. Charging process is simple and automatic.
2. It doesn't require any human input.
3. It is small in size and compact compared to a wired system.
4. Compared to a wired system, it requires less space and can be installed underneath the surface.
5. As it does not have any contact, there are no exposed electric connections.
6. It can avoid electrocution risk typically arising from power cords.
7. Newer WPT designs are getting better in efficiency.

Power flow in WPT system

The block diagram for Power flow in WPT system is like below. The RF inverter converts the frequency of the power. Usually, the RF inverter will also change the voltage of the power. Given that power is $P=VI$, and impedance $Z=V/I$, the RF inverter will also convert the impedance of the power. The rectifier on the Rx side will change the frequency of the power. [6].



WPT-systems for charging EVs

Depicts the base components of a WPT system for EV charging. It consists of two prime sub-systems, one of which is existing underneath the road surface and the second is found into the vehicle underbody. The first subsystem includes the source of energy, rectifier and high frequency inverter, primary compensation network and the primary/transmitter coil (Tx). The built subsystem in EVs, has the secondary/receiving coil (Rx) and secondary compensation network composes a resonance circuit that supplies into a high frequency rectifier, filter and the battery. The sub-systems are separated by an air gap. The distance between the two systems depends on the type of vehicle, ground clearance and road conditions such as pavement thickness. Usually, the air gap is smaller than 0.4 m. Additionally, both sub-systems share information via a communication link.

Conclusion

The electrification of transportation is underway and wireless charging is poised to play a significant role. Wireless charging systems provide a convenient hands-off method to charge electric vehicles at the same speed and efficiency as standard conductive AC chargers. A broad view of Wireless power transfer applications has been seen and wireless charging of Electric vehicles using WPTs technology and its types has been studied.

Future plan of Action

In future we can use electric appliances by using electricity without wire. In the below, discussing some potential scope of using wireless power transfer technology.

1. **Solar Power Satellite:** Satellite with solar panel is used to capture maximum amount of solar energy from the sun in the space.
2. **Wirelessly powered home appliances:** In future there will be a transmitting device inside home that will transmit power to all the home appliances.
3. **Wirelessly charging of electric vehicle on way:** In future there will be no need to stop and charge the electrical vehicles. On the way charging can be done.
4. Universal power source in emergency.
5. **Wireless Traction train:** In future train may get power wirelessly. There will be no need to connect the train with wire.

References:

- [1]. Fariborz Musavi and Wilson Eberle, "Overview of wireless power transfer technologies for electric vehicle battery charging", *The Institution of Engineering and Technology*, 2014, Vol. 7, Issue. 1, pp. 60–66: DOI: 10.1049/iet-pel.2013.0047.
- [2]. Nguyen Thi Diep et al, "Wireless power transfer system design for electric vehicle dynamic charging application", *International Journal of Power Electronics and Drive System (IJPEDS)*, Vol. 9, No. 4, September 2020, pp. 1468~1480 ISSN: 2088-8694, DOI: 10.11591/ijped.v10.i3.1468-1480
- [3]. Vekil Sari, "Design and Implementation of a Wireless Power Transfer System for Electric Vehicles", *World Electric Vehicle Journal*, 15(3), 2024, 110; Pp.2-26, <https://doi.org/10.3390/wevj15030110>.



- [4]. Abdel Rahman Farghly et al. “A Comprehensive Review of Wireless Power Transfer Techniques for Electric Vehicle Charging,” *Comprehensive Review of Wireless Power Transfer Techniques for Electric Vehicle Charging*, Volume 13, 2025, Pp – 199683 -199718.
- [5]. Hany S.E. Mansour et. al. “Wireless charging systems for electric vehicles: Review”, *Green Energy and Intelligent Transportation*, 5 (2026) 100371, Pp No: 1-23.
- [6]. Nassim Iqteit, Khalid Yahya and Sajjad Ahmad Khan, “Wireless power charging in electric vehicles”, 15 February 2021, DOI: 10.5772/intechopen.96115.