IJARSCT

International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

ISSN: 2581-9429 Volume 6, Issue 17, April 2026 Impact Factor: 8.2

Wireless Charging of Electric Vehicle While Driving

Mrs. Priti Sudhakar Gund Pujari[1], Miss. Pratiksha Raykar[2], Miss. Samiksha Sanap[3], Miss. Sakshi Kakde[4], Miss. Sakshi Jagtap[5]

Assistant Prof. Electronic & Telecommunication Engineering Department[1]

Studentss, Information & Technology Engineering Department[2,3,4]

Student, Mechanical Engineering Department[5]

Adsul's Technical Campus, Ahilyanagar, India

Abstract: *Static wireless charging is becoming popular all over the world to charge the electric vehicle (EV). But an EV cannot go too far with a full charge. It will need more batteries to increase its range. Dynamic wireless charging is introduced to EVs to capitally increase their driving range and get rid of heavy batteries. Some modern EVs are getting off this situation. But with Dynamic WPT the need of plug-in charge and static WPT will be removed gradually and the total run of an EV can be limitless. If we charge an EV while it is driven, we do not need to stop or think for charging it again. Eventually, in the future the batteries can be also removed from EVs by applying this method in everywhere. Wireless charging needs two kinds of coils named the transmitter coil and the receiver coil. The receiver coil will collect power from the transmitter coil while going over it in the means of mutual induction. But the variation of distance between two adjacent coils affects the wireless power transfer (WPT). To see the variation in WPT, a system of two Archimedean coils of copper is designed and simulated for vertical and horizontal misalignment in Ansys Maxwell simulation software. The transfer power for 150 mm air gap is 3.74 kW and transfer efficiency are gained up to 92.4%. The charging time is around 1 hour and 39 minutes to fully charge its battery from 0 state for a 150mm air gap for an EV with 6.1 kW power may take. Also, a charging lane is designed for dynamic charging. Then the power transfer is calculated from mutual inductance when the EV is driven on a charging lane. From the load power, it can be calculated how further an EV can go with this extra power.*

Keywords: Wireless charging, EV (electric vehicles), static and dynamic charging, Plug-in Electric Vehicles (PEVs), Wireless Power Transmission (WPT)

I. INTRODUCTION

Electric Vehicles have started their journey when General Motors made the world's first electric vehicle during 1996. But, with the initiation of Chevrolet and Nissan, manufacturers of EV have started a magnificent journey through the technology, and the acceptance of users for it causes no harm to the environment. Also, stepping into EV is considered as to take a significant step towards protecting the environment, enhancing transportation durability and diminishing fuel dependency. With this great advantage, many automobile manufacturers have started to make immense investments to bring improvement in the technology of the electric automobile [1], [2]. Wireless Charging System (WCS) is working on the theory of Mutual induction is a phenomenon introduced by Sir Nikola Tesla in 1887 where an induced emf is caused in the second coil known as receiver coil can create electrical energy with a given current in the first coil known as transmitter coil [3]. The current development in this sector by the automobile companies and the research institutes show that within the next ten to twenty years charge while driving (CWD) infrastructure can be stationed for widespread use. That is why many companies have been looking at ways to not only extend the range of EVs by wireless charging but also to make the charging process seamlessly automatic. [4] Paper design and S-S (series-series) WPT system with a 40 kHz to 85 kHz resonant frequency. They found that the WPT system is in better use for light-duty EV applications. But, one of the big challenges facing EV makers is the issue of dynamic charging. Since wireless charging of EV is introduced, two methods are very effective for WPT.

Nowadays, the depletion of fossil fuels and the phenomena of global warming are key factors that push us to change our modes of transportation. Vehicle-based internal combustion engines are no longer desired, they contribute significantly to climate changes, and they are dependent to the petroleum product. The electric vehicle (EV) is an alternative choice, it can be considered as a suitable method for a sustainable transportation, it has the advantage of zero emissions and it is powered by electricity which can be considered as a renewable energy. However, the basic configuration of an EV contains a rechargeable battery pack which can be considered as its main drawback. The battery needs to be recharged frequently because of its low capacity; thus, the charging operation takes several hours, which reduce the driving range of the EV and limit its success in the market. Several methods are used to recharge EV batteries. In the conductive charging, the power is transferred efficiently to the vehicle by cables, but the user must intervene in this operation which is dangerous in certain specific conditions such as snow and rain that can cause electric shocks. Powering an electric vehicle using the wireless method is much easier and safer for the user, thus, the absence of physical contact (no mechanical friction) can prolong the product life and reduce its maintenance. The wireless power transfer (WPT) can be in a stationary or dynamic way. In stationary mode, the vehicle is wirelessly charged while parked in a location (parking or garage) equipped with a specialized power utility. The dynamic charging which means that the vehicle can be recharged while moving is invented as an attempt to reduce the size of the battery (i.e. reduce long charging times and vehicle weight) and extend the vehicle driving range.

Scope of Project:

It is looking increasing likely that electric vehicles will play a major role in the future of road transportation. While Commercial electric vehicle exists, their uptake has been limited due to high purchase costs, limited battery range, and a lack of charging convenience. Furthermore, while developments are underway, electric and hybrid drive trains are yet to be efficiently integrated with a heavy goods vehicle. A novel way to overcome such challenges are Electric Road Systems; a branch of technologies that allow vehicles to charge while in motion. Limited information exists regarding the comparative performance of ERS solutions, market readiness, costs, and implementation issues. To this end, the World Road Association commissioned TRL to undertake a state-of-the art review and feasibility study of ERS concepts; focusing on ERS implementation from the perspective of a road administration.

II. LITERATURE SURVEY

Nikola Tesla was a pioneer in the field of wireless power transfer (WPT) and he developed the concept of WPT in the late 19th and early 20th centuries. Tesla envisioned a future where power could be transmitted wirelessly, without the need for wires and cables. Tesla’s original experiments with WPT involved the use of high-frequency electromagnetic fields to transfer power over short distances. However, the technology at the time was not advanced enough to make widespread use of this concept [1].

A.C. Bagchi, A. Kamineni, R. A. Zane and R. Carlson, "Review and Comparative Analysis of Topologies and Control Methods in Dynamic Wireless Charging of Electric Vehicles," DWPT systems have been developed to solve EV range and battery size limitations, there are still significant challenges to achieving stability and interoperability [2].

S. Manurkar, H. Satre, B. Kolekar, P. Patil, S Bailmare, “Wireless Charging of Electric Vehicle,” wireless power transfer can be implemented as either a static or dynamic charging system, with the latter allowing for charging of vehicles even when in motion [4]. P. Magudeswaran, G Pradeeba, S. Priyadarshini, M. Sherline Flora, “Dynamic Wireless Electric Vehicle Charging System,” This paper presented a design for wireless charging of electric cars, which offers many benefits compared to wired charging systems [5].

Darshana wagh, “Wireless Charging Station for Electric Vehicle.” The paper discusses the development of wireless charging methods for electric vehicles, including both static and dynamic charging systems [6].

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 17, April 2026 Impact Factor: 8.2

Swaraj Ravindra Jape, Archana Thosar "Comparison of Electric Motors for Electric Vehicle Application." the study compares five different electric motors for electric vehicle applications based on various criteria such as power-to-weight ratio, torque-speed characteristics, efficiency, cost of the controller, and cost of the motor. The purpose of the comparative evaluation is to determine which motor would be the most suitable for use in electric vehicles [7].

Christ and M G. Douglas, "Evaluation of Wireless Resonant Power Transfer System with Human Electromagnetic Exposure Limits." This study investigates the potential exposure of individuals in the reactive near-field of wireless power transfer systems, with the objective of providing scientifically sound recommendations for the evaluation of such systems in terms of human exposure limits. The study seeks to guide the evaluation of potential risks associated with wireless power transfer systems and ensure compliance with established safety standards [8].

III. WIRELESS POWER TRANSFER

A. WPT System:

In a generic WPT system for EV, high-frequency ac power is supplied in the transmitter end and transfer the power to the receiver end over a specified distance. As RIPT is the most effective WPT for EV so, it is discussed here briefly and the whole structure is designed based on RIPT.

B. Resonant Inductive Power Transfer:

IPT method can transfer power by the inductive coil. It is the most efficient process for WPT in the static method where the receiver coil is in the centered position over the transmitter coil. But if we think of dynamic charging then the receiver coil is movable as shown in Fig. 1 and can barely collect the magnetic flux from the transmitter coil. Hence a capacitor is used on the transmitter side and as well as on the receiver side known as a compensation network to resonant the transmitter coil and the receiver coil [20]. This method is called the RIPT method. RIPT method is the most efficient - among all technologies to transfer power wirelessly in short-range [21]. There are four compensation networks in the RIPT method, series- series (s-s) compensation, series-parallel (s-p) compensation, parallel- parallel (p-p) compensation, and parallelseries (p-s) compensation. In this work, s-s compensation is used because, in the s-s compensation network, maximum power is transferred to the receiving pad [22], [23]. Also, RIPT has a higher switching frequency compared to IPT [24].

C. Charging Method:

Low-frequency ac power from the grid is converted into a high frequency (hf) ac through ac-dc converter and dc-ac inverter. To ensure maximum power transfer to the receiving end, s-s compensation topology is used in the transmitter coil and the receiver coil. The transmitting pad is typically mounted beneath the surface of the road and the receiving pad is mounted underneath the vehicle [25]. The receiver pad is usually mounted lower from the frame of the EV to help to catch more magnetic flux. The high-frequency AC is then converted into DC by using an AC/DC converter and sent to the battery bank. The battery management system (BMS) communications and power controller are used to ensure stable operation and avoid any safety issues. The whole process of charging method from grid to vehicle (G2V) is shown in Fig. 2. Here, the main work is focused on the transmitter coil and the receiver coil as it is the most important part of the whole system assuming the other parameters ideal. Varying the properties of these two coils can bring improvement in the overall efficiency.

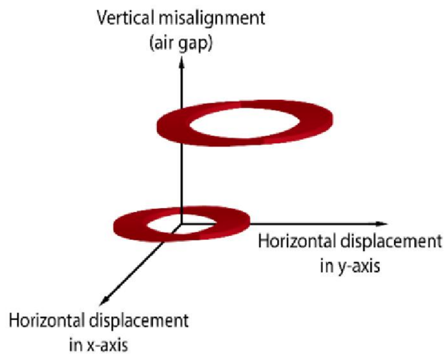

Fig. 1. Transmission Coil & Receiver Coil Misalignment

D. Coil Design:

There are different shapes of coil used in WPT systems. Among them, the circular coil is the most effective structure in high-frequency wireless transfers [27] as there are no sharp edges. So, the eddy current is kept to minimum [12]. The high magnetic field produced by the coil causes better performance in the WPT system.

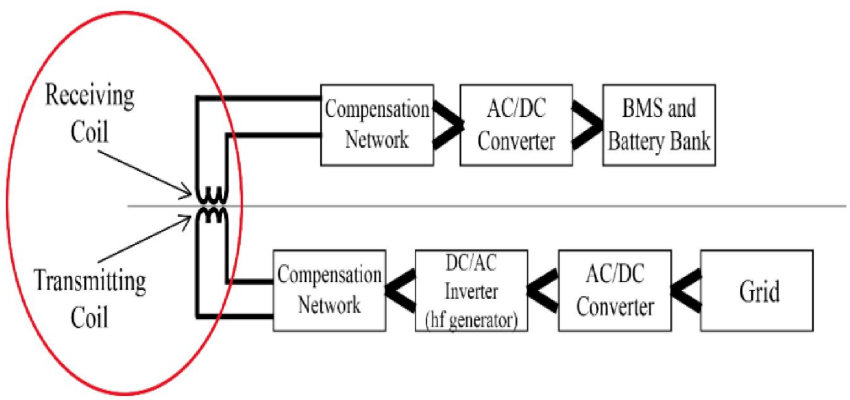

Fig. 2. Block Diagram of Grid to Vehicle Wireless Charging System for an EV

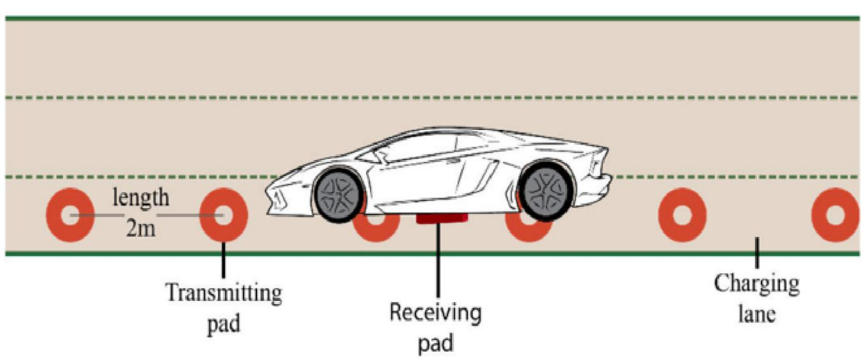

Fig. 3. Scenario Layout Position of Transmitting Pad for Dynamic Charging

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 17, April 2026
Impact Factor: 8.2

IV. SYSTEM ARCHITECTURE

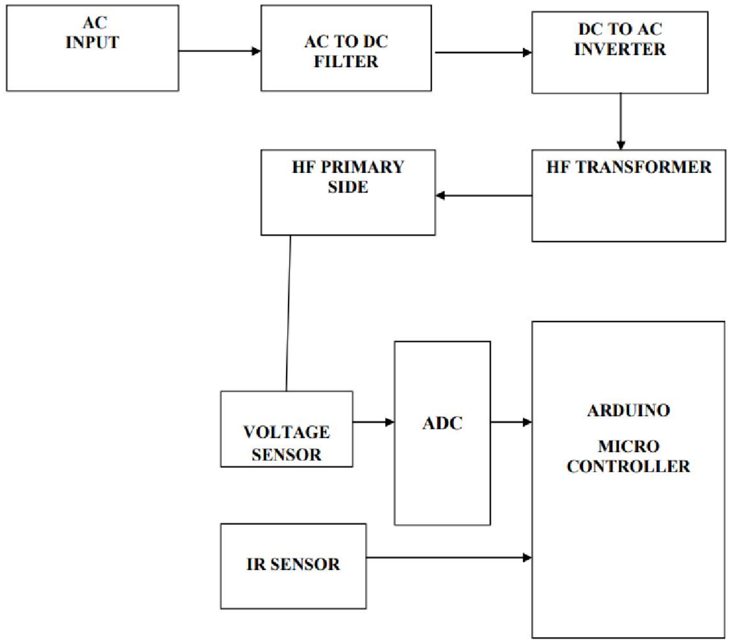

Fig. 4. Block Diagram of Transmitter Section

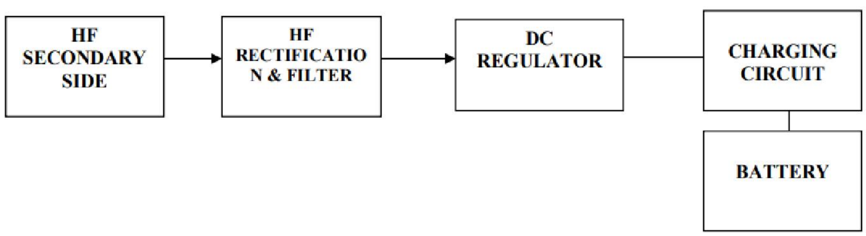

Fig. 5. Block Diagram of Receiver Section

V. CONCLUSION

Research on WPT is getting popular these years. This work compares the most famous WPT technologies and develops an effective one known RIPT. The RIPT method is used for resonating the transmitter coil frequency and receiver coil frequency. It shows how air gap and misalignment affect the WPT while the EV is driven in the charging lane. Firstly, WPT is simulated in the Ansoft Maxwell 3D simulation software to see the reduction in mutual inductance for air gap and horizontal displacement between the coils in x-axis and y-axis. Then verify the output data using mathematical equations. Equations for self-inductance, mutual inductance, coupling coefficient, voltage, and current are discussed here. The calculation for load power and efficiency for the 150mm air gap is shown. From the load power, the time for the full charge of the battery of an EV can be easily determined. Hence, a model is established to see the power transfer for different speeds and finally how far the EV can go with this consumed power. But, how efficiently the receiver pad can catch the power from the transmitter pad is also depends on the speed of the EV. Shielding materials like ferrite planner and aluminum plates can be used to transfer more power to the receiving end. This work helps to understand the wireless charging of EVs in the track for high resonant frequency in the means of RIPT and can be extended for future work in this field. The main purpose of this work is to show the calculation of wireless power transfer of an EV while it is in motion based on vertical and horizontal misalignment. Misalignment of coils are also designed and simulated for getting a clear and broad knowledge about dynamic WPT.

In this system, we are presenting the Wireless Power Transmission. As the electric vehicle in the market is increasing. We can use the wireless charging system to charge our vehicles. This system shows the efficiency and implementation of the charging station in future technology. This paper also covers future technology like payment through RFID tags and self-serviced entry and exit gate to maintain congestion at the station. This will be helpful for those who are doing research in the field of wireless power transmission. And many had come up with the greatest invention like charging mobile wirelessly, and other electronic gadgets too. This could be the future scope for developing the charging station, As electric vehicle are increasing in demand.

VI. FUTURE SCOPE

The transfer power for 150 mm air gap is 3.74 kW and transfer efficiency are gained up to 92.4%. The charging time is around 1 hour and 39 minutes to fully charge its battery from 0 state for a 150mm air gap for an EV with 5.1 kW power may take. Wireless power transfer technology is a field that has a huge potential of becoming a mainstream technology in the future. The proposed wireless power transfer circuit can be used for EV charging applications. With the necessary research and development in this field, it is possible to create an electric bicycle from a conventional bicycle that is capable of charging wirelessly. In the future, the advanced circuit as used the coil design can be imported from the wireless power transfer circuit that is closer to the real world hardware. With adequate development and innovation in this field, it is certainly possible to create wireless power charging stations capable of charging electric bicycles and electric cars or any heavy EVs from the same power charging station, at a faster charging rate than currently available charging techniques.

ACKNOWLEDGMENT

It gives us great pleasure in presenting the paper on “Wireless Charging of Electric Vehicle while driving”. We would like to take this opportunity to thank our guide, Prof. Priti Sudhakar Gund Pujari, Professor, E&TC Department, Adsul’s technical Campus, Ahlyanagar, for giving us all the help and guidance we needed. We are grateful to her for hers kind support, and valuable suggestions were very helpful.

REFERENCES

[1] Nicola Tesla, “The transmission of electrical energy without wires”, Electrical World and Engineer, March 1905.

[2] A. C. Bagchi, A. Kamineni, R. A. Zane and R. Carlson, "Review and Comparative Analysis of Topologies and Control Methods in Dynamic Wireless Charging of Electric Vehicles." in IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 9, no. 4, pp. 4947-4962, Aug. 2021.

[3] Philip Machura, Quan Li, “A critical review on wireless charging for electric vehicles, “Renewable and Sustainable Energy Reviews, Volume 104,2019, Pages 209-234, ISSN 1364-0321

[4] S. Manurkar, H. Satre, B. Kolekar, P. Patil, S Bailmare, “Wireless Charging of Electric Vehicle.” International Research Journal of Engineering and Technology, Vol. 07, No. 03, pp. 2395-0072, Mar 2020.

[5] P. Magudeswaran, G Pradeeba, S. Priyadarshini, M. Sherline Flora, “Dynamic Wireless Electric Vehicle Charging System” International Research Journal of Engineering and Technology, Vol.6, No. 3, March 2019.

[6] Darshana wagh, “Wireless Charging Station for Electric Vehicle” International Research Journal of Engineering and Technology, Vol. 08, No. 01, Jan 2021.

[7] Swaraj Ravindra Jape, Archana Thosar “Comparison of Electric Motors for Electric Vehicle Application” International Research Journal of Engineering and Technology, Vol. 06, No. 09, eISSN: 2319-1163, pISSN: 2321-7308 Sep-2017.

[8] A Christ and M G. Douglas, "Evaluation of Wireless Resonant Power Transfer System with Human Electromagnetic Exposure Limits", IEEE Trans. on Electromagnetic Compatibility, vol. 55, no. 2, pp. 265-274, 2013.

[9] A. G. Akhil, S. Harisankar, K. Jishnu, S. Sreenand, Vivek Vijay, C. A. Asha, P. K. Preetha, “Coupled Wireless Charging System for Electric Vehicles” 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), March 2021.

[10]Aqueel Ahmad, Mohammad Saad Alam, Rakan Chabaan, “A Comprehensive Review of Wireless Charging Technologies for Electric Vehicles” IEEE Transactions on Transportation Electrification, Volume: 4, No. 01, pp. 38 – 63, March 2018.

[11]Zicheng Bi, Tianze Kan, Chunting Chris Mi, Yiming Zhang, Zhengming Zhao, Gregory A. Keoleian, “A review of wireless power transfer for electric vehicles: Prospects to enhance sustainable mobility,” Applied Energy, Volume 179,2016,Pages 413-425,ISSN 0306-2619

[12]A. Zaheer, M. Neath, H. Z. Z. Beh and G. A. Covic, "A Dynamic EV Charging System for Slow Moving Traffic Applications," in IEEE Transactions on Transportation Electrification, vol. 3, no. 2, pp. 354-369, June 2017,

[13]A. Mahesh, B. Chokkalingam and L. Mihet-Popa, "Inductive Wireless Power Transfer Charging for Electric Vehicles–A Review," in IEEE Access, vol. 9, pp. 137667-137713, 2021.

[14]Chirag Panchal, Sascha Stegen, Junwei Lu, “Review of static and dynamic wireless electric vehicle charging system,”Engineering Science and Technology, an International Journal, Volume 21, Issue 5,2018,Pages 922-937,ISSN 2215-0986

[15]X. Chen-yang, L. Chao-wei and Z. Juan, "Analysis of power transfer characteristic of capacitive power transfer system and inductively coupled power transfer system," 2011 International Conference on Mechatronic Science, Electric Engineering and Computer (MEC), Jilin, China, 2011, pp. 1281-1285.

[16]S. A. Kashani, A. Soleimani, A. Khosravi, and M. Mirsalim, “State-of-the-Art Research on Wireless Charging of Electric Vehicles Using Solar Energy,” Energies, vol. 16, no. 1, p. 282, Dec. 2022.

[17]D. Patil, M. K. McDonough, J. M. Miller, B. Fahimi, and P. T. Balsara, “Wireless power transfer for vehicular applications: Overview and challenges,” IEEE Transactions on Transportation Electrification, vol. 4, no. 1, pp. 3–37, March 2018.