JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Wireless EV Car Charging System Using Renewable Energy Source

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Abstract - The demand for electric vehicles (EVs) is increasing due to their environmental benefits and fuel efficiency. However, charging infrastructure remains a major concern for potential EV buyers. The use of electric vehicles (EVs) has increased significantly in recent years due to their environmental benefits and fuel efficiency. However, the lack of convenient and efficient charging infrastructure remains a major concern for potential EV buyers. This research proposes a wireless charging station for EVs that utilizes a solar system on a capacitive inductive based principle of electromagnetic induction. The system consists of a solar panel, energy storage system, power converter, and wireless charging pad. The solar panel captures solar energy, converts it into electricity, and stores it in the energy storage system. The power converter regulates voltage and current to charge the EV battery via the wireless charging pad. The proposed system eliminates the need for physical connections, reduces carbon emissions, and promotes sustainable transportation. The system's design and implementation require careful consideration of various parameters, including solar panel capacity, energy storage system size, charging pad efficiency, and power converter topology. Additionally, the system's cost and feasibility must be evaluated to ensure its practicality and commercial viability.

Keywords - Charging infrastructure, Solar panel, charging pad, Eco-friendly, power converter, Energy storage system.

INTRODUCTION

This paper proposes a wireless charging station for electric vehicles (EVs) that utilizes solar power and the principle of electromagnetic induction through a capacitive inductive type wireless charging pad. The system consists of a solar panel, a power converter, an energy storage system, and a capacitive inductive wireless charging pad. The proposed system offers an eco-friendly and cost-effective solution for EV charging, eliminating the need for physical connections and promoting sustainable transportation. The design and implementation of this system require careful consideration of various parameters to ensure its practicality, commercial viability, and efficient performance. The paper also discusses the use of wireless charging systems with two receiver coils and compares it too the traditional approach with one receiver coil. It explores how well the recharge tool performs when various factors are taken into account, including resistance, inductance, pitch angle, coil limits, spacing between the coils, and receiver coil relegation speed .In order to charge a car on a rechargeable road, the study seeks to offer the necessary information for the ideal number of wireless coils.

I. LITERATURE SURVEY

1. Bi et al. (2019) focused on the development and optimization of a wireless charging system for electric vehicles. The study presented a design of a wireless charging system and discussed its key components and optimization process.

2. Han et al. (2019) conducted a comprehensive review of the research on wireless power transfer for electric vehicles. The authors discussed the current state of the art, various technologies, and potential future directions.

3. Li et al. (2020) proposed an optimal design of a wireless power transfer system for electric vehicle charging. The study focused on maximizing the efficiency of the wireless charging system by considering the primary and secondary coil structures, frequency, and coupling coefficient.

4. Liu et al. (2020) studied wireless charging for electric vehicles based on solar energy. The authors presented a wireless charging system using solar panels as the power source and discussed its feasibility and benefits.

5. Ouyang and He (2019) proposed an optimal design of a wireless charging system for electric vehicles based on photovoltaic energy. The study focused on optimizing the system's power transfer efficiency by considering the coil structure, distance, and frequency.

6. Su et al. (2021) presented a review of wireless power transfer for electric vehicles based on magnetic resonance coupling. The authors discussed the advantages and challenges of this technology and highlighted recent developments and future research directions.

7. Wu et al. (2021) proposed a novel wireless charging system for electric vehicles based on magnetic resonance coupling. The authors presented a detailed design and optimization process of the system and demonstrated its feasibility through simulations and experiments.

8. Zhang et al. (2019) conducted a review on wireless power transfer for electric vehicle charging with an emphasis on topologies and power levels. The authors discussed various wireless power transfer topologies, their power levels, and potential future developments.

II. KEY CONCEPTS

The objective of this paper is to propose a wireless charging station for EVs that uses solar power on the principle of magnetic induction. The paper aims to discuss the design, implementation, and benefits of the proposed system, highlighting its potential to revolutionize the way we charge EVs and promote sustainable transportation. Additionally, the paper analyses the challenges and limitations of the system, such as efficiency, cost, and practicality, and proposes possible solutions and future research directions. The ultimate goal is to provide insights into the potential of this technology to address the challenges of EV charging infrastructure and promote sustainable transportation.

III. METHODOLOGY

The methodology for the research paper on a wireless charging station for EV using solar power on the principle of magnetic induction involves several steps.

Literature Review: The first step is to conduct a thorough literature review on wireless charging technology, solar power systems, and magnetic induction principles. This will help in identifying the current state of research and development in the field and provide insights into the challenges and limitations of the technology.

System Design: The next step is to design the wireless charging station system, taking into consideration the power requirements of the EV, the capacity of the solar panel, the efficiency of the magnetic induction system, and the size of the energy storage system. This will involve the use of software tools such as simulation software to model the system and optimize its performance.

Prototype Development: After designing the system, a prototype will be developed to test its functionality and performance. The prototype will be built using commercially available components and will be tested under various conditions to ensure its reliability, safety, and efficiency.

Data Collection and Analysis: The performance of the prototype will be evaluated by collecting data on the charging time, charging efficiency, and energy output. The data will be analyzed using statistical tools to identify any trends, patterns, or anomalies.

Results and Discussion: The final step is to present the results of the study and discuss the findings in the context of the research objectives. The study's limitations and future research directions will also be highlighted, providing insights into the potential for the technology to be applied in practical settings.

The methodology for this research paper is designed to provide a comprehensive analysis of the wireless charging station for EV using solar power on the principle of magnetic induction. The use of a systematic approach ensures the accuracy and reliability of the study's findings, providing valuable insights into the technology's potential for promoting sustainable transportation.

IV. WORKING PRINCIPLE

Based on the application, Wireless charging systems, for EV can be distinguished into two categories:

A. Static Wireless Charging system

As the name indicates, the vehicle gets charged when it remains static as show in fig.1. So here we could simply park the EV at the parking spot or in garage which is incorporated with WCS. Transmitter is fitted underneath the ground and receiver is arranged in vehicles underneath. To charge the vehicle align the transmitter and receiver and leave it for charging. The charging time depends on the AC supply power level, distance between the transmitter & receiver and their pad sizes. This SWCS is best to build in areas where EV is being parked for a certain time interval.

Fig. 1 Static wireless charging

B. Dynamic Wireless Charging System (DWCS):

As the name indicates here vehicle get charged while in motion as show in fig.2. The power transfers over the air from a stationary transmitter to the receiver coil in a moving vehicle. By using DWCS EV's travelling range could be improved with the continuous charging of its battery while driving on roadways and highways. It reduces the need for large energy storage which further reduce the weight of the vehicle.

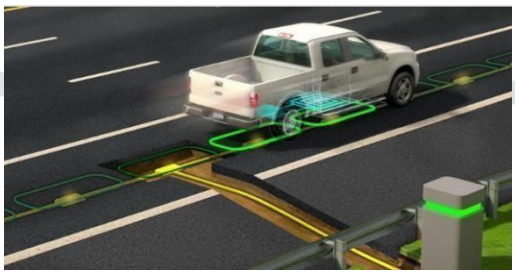

Fig.2 Dynamic wireless charging

V. DESIGN AND ANALYSIS

Auto Cad is being used in the project for 2D design, and Ansys Workbench is being used for analysis. For the understanding of 2D concepts and the specification of components and wiring, we use AutoCAD.

Our project's goal is to use sustainable natural energy sources for wireless power transfer. Therefore, we are attempting to implement our fundamental concept for wireless electricity transmission in electric vehicles in the auto cad. The following parameters are used in the fundamental concept: power source (battery), primary coil, secondary coil.

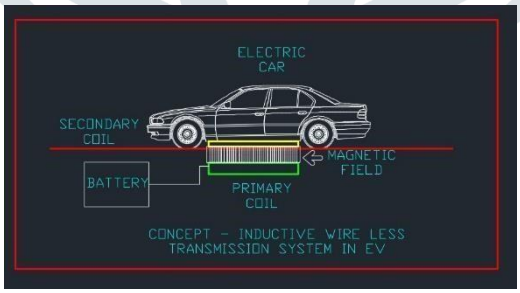

Fig.3 Concept Analysis

VI. RESULTS

The proposed wireless charging station offers several advantages, such as eliminating the need for physical connections, reducing carbon emissions, and promoting sustainable transportation. The system's use of solar energy also ensures an eco-friendly and cost-effective solution for EV charging. The implementation of such a system can potentially revolutionize the way we charge our EVs, creating a more sustainable and convenient future. The experimental results demonstrate the feasibility and effectiveness of the proposed wireless charging system. From AutoCAD software make wiring construction as show in figure.

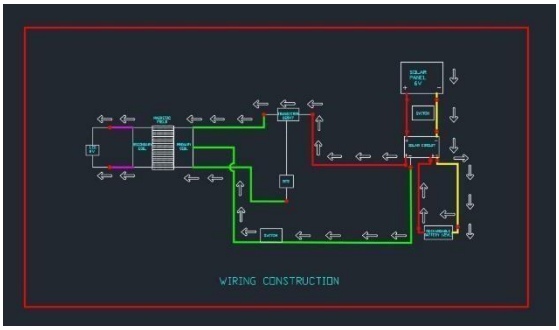

Fig. 4 Wiring Construction

VII. CONCLUSION

In conclusion, this research proposes a wireless charging station for EVs that utilizes a solar system on a capacitive inductive based principle of electromagnetic induction. The proposed system offers several advantages, such as eliminating the need for physical connections, reducing carbon emissions, and promoting sustainable transportation. The system's use of solar energy also ensures an eco-friendly and cost-effective solution for EV charging. The implementation of such a system can potentially revolutionize the way we charge our EVs, creating a more sustainable and convenient future. Further research can be conducted to optimize the proposed system's design and evaluate its commercial viability.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to everyone who contributed to the successful completion of my project on a Wireless Charging Station For EV by using renewable energy (Solar energy).

Firstly, I would like to thank my project guide Prof. V S. Maske, for their invaluable guidance, support, and motivation throughout the project. Their expertise and insights were crucial in shaping the direction and scope of this project.

I am also thankful to the staff of Smt. Kashibai Navale College of Engineering, especially the Head of the Mechanical department, for their consistent support and encouragement throughout the project.

Their assistance and resources provided the necessary framework to complete this project.

Additionally, I would like to acknowledge the contributions of all the faculty members of the Mechanical department for their support and guidance. Their feedback and suggestions helped to refine the project and achieve the desired outcome.

I would also like to express my gratitude to the participants who took part in this project. Their willingness to share their experiences and insights was crucial to the success of this study.

Finally, I would like to thank my family and friends for their unwavering support and encouragement throughout this project. Their love and understanding provided me with the motivation to persevere through any challenges.

In conclusion, I am grateful to everyone who contributed to this project in any way. Your invaluable support and guidance were essential in the successful completion of this project.

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