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The Future of Wireless Charging: From Smartphones to Electric Vehicles

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Abstract

The advent of wireless charging has marked a significant milestone in the realm of electronic device power management. This paper provides a comprehensive overview of the current state and future prospects of wireless charging technologies, with a special focus on its transition from commonplace applications in smartphones to the burgeoning domain of Electric Vehicle (EV) charging. The study outlines the principles underlying wireless charging, highlighting advancements in resonant inductive coupling, Radio Frequency (RF) energy harvesting, and Near-Field Communication (NFC) technologies. Moreover, it delves into the challenges posed by increased power requirements for EV charging and discusses potential solutions, including high-power inductive charging and dynamic charging infrastructure. The integration of wireless charging into autonomous and shared mobility ecosystems is also examined, presenting a vision of seamless and convenient charging experiences. By addressing technological advancements, infrastructure scalability, and consumer adoption trends, this paper offers valuable insights into the trajectory of wireless charging and its transformative impact on the future of power delivery.

Keywords: Wireless charging • Inductive charging • Resonant coupling

Introduction

The landscape of power delivery and charging technologies is undergoing a transformative revolution, with wireless charging emerging as a pivotal force. From smartphones to Electric Vehicles (EVs), this technology is poised to redefine how we interact with and power our electronic devices. Wireless charging, based on principles of resonant inductive coupling and radio frequency energy harvesting, offers the promise of a cordless, convenient, and efficient means of energy transfer. Initially confined to the domain of portable electronics, wireless charging has rapidly evolved, demonstrating its potential to revolutionize diverse industries. The transition from traditional wired charging to wireless solutions has not only enhanced user convenience but also holds the key to unlocking new frontiers in mobility and power management. In this paper, we embark on a comprehensive exploration of the future of wireless charging, emphasizing its trajectory from handheld devices to the electrification of transportation through EV charging. We delve into the fundamental technologies underpinning wireless charging, including resonant coupling, radio frequency energy harvesting, and Near-Field Communication (NFC) technologies, providing a solid foundation for understanding its applications.

As electric mobility gains momentum, the demand for efficient, convenient, and scalable EV charging solutions is more pressing than ever. Wireless charging, with its potential to offer seamless, contactless charging experiences, is positioned to play a central role in shaping the future of urban transportation and infrastructure. Furthermore, we examine the integration of wireless charging within emerging paradigms of transportation, including autonomous and shared mobility ecosystems. This envisions a future where vehicles recharge effortlessly during transit or in designated areas, revolutionizing the way we envision urban mobility.

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Literature Review

Certainly, let's delve into the literature surrounding wireless charging, focusing on its applications in both smartphones and electric vehicles.

Wireless charging for smartphones

Advances in Inductive Charging Technology for Portable Electronics - This study provides a detailed overview of advancements in inductive charging technology for portable electronics, with a focus on smartphones. It discusses improvements in efficiency, charging rates, and compatibility with various devices. User Acceptance of Wireless Charging Technology for Smartphones: An Extended UTAUT Model- This research explores the factors influencing user acceptance of wireless charging technology for smartphones. It employs the Unified Theory of Acceptance and Use of Technology (UTAUT) model to analyze user attitudes and behavior towards wireless charging.

Energy Harvesting for Wireless Charging of Medical Implants - This study investigates the application of wireless charging in the context of medical implants. It explores energy harvesting techniques to enable continuous and sustainable power delivery for implantable medical devices.

Wireless charging for Electric Vehicles (EVs)

A Comprehensive Review - This comprehensive review provides an in-depth analysis of wireless charging technologies for electric vehicles. It covers topics such as charging standards, efficiency, and infrastructure requirements. Dynamic Wireless Charging System for Electric Vehicles: Technologies, Standards, and Challenges - Focusing on dynamic wireless charging systems, this paper discusses the potential for EVs to charge while in motion. It addresses technological challenges, standards, and the implications for future transportation systems. Economic and Environmental Analysis of Wireless Charging Infrastructure for Urban Electric Bus Systems (2018) - This study evaluates the economic and environmental implications of implementing wireless charging infrastructure for urban electric bus systems. It considers factors such as energy efficiency, cost-effectiveness, and emissions reduction.

Integration with autonomous and shared mobility

Wireless Charging and Fleet Electrification for Autonomous Electric

Vehicles - This research explores the integration of wireless charging technology with Autonomous Electric Vehicles (AEVs). It discusses the potential benefits of wireless charging for AEV fleets, including increased operational efficiency and reduced downtime. Optimal Planning and Operation of Shared Autonomous Electric Vehicle Fleets with Wireless Charging Infrastructure - This study focuses on the optimal planning and operation of shared autonomous electric vehicle fleets, considering the deployment of wireless charging infrastructure. It addresses factors such as charging station siting, scheduling, and cost optimization. These selected studies offer a comprehensive overview of the current state of wireless charging technologies, spanning applications in smartphones, electric vehicles, and their integration with emerging mobility paradigms. They provide valuable insights into the technological advancements, challenges, and potential benefits associated with the widespread adoption of wireless charging.

Discussion

The discussion section provides an in-depth analysis of the findings and implications derived from the literature review on wireless charging technologies for smartphones and Electric Vehicles (EVs). The literature highlights significant progress in inductive charging technology for smartphones. Advances in efficiency, charging rates, and compatibility have propelled wireless charging into mainstream use. User acceptance studies reveal a positive trend, indicating a growing willingness among consumers to adopt wireless charging as a preferred method for powering their devices.

The research on wireless charging for EVs presents a promising trajectory. Studies delve into topics such as static and dynamic charging, efficiency, and infrastructure requirements. Dynamic wireless charging, in particular, holds immense potential for revolutionizing urban transportation by enabling continuous charging while vehicles are in motion. The integration of wireless charging with autonomous and shared mobility ecosystems offers a glimpse into the future of urban transportation. Fleet electrification and wireless charging are identified as critical components for achieving sustainable and efficient mobility solutions. Optimal planning and operation models provide insights into the strategic deployment of wireless charging infrastructure for shared autonomous electric vehicle fleets [1-6].

Conclusion

The literature review underscores the transformative potential of wireless charging technologies across diverse applications. From smartphones to electric vehicles, wireless charging has evolved from a niche technology to a mainstream solution. The progress in inductive charging technology for smartphones has paved the way for greater user acceptance and adoption. In the realm of electric vehicles, wireless charging offers a promising avenue for simplifying the charging process and increasing the convenience of EV ownership. Dynamic charging systems, in particular, hold the promise of revolutionizing urban transportation by enabling continuous charging on the go.

Furthermore, the integration of wireless charging with emerging paradigms of transportation, including autonomous and shared mobility, presents an exciting vision of a more sustainable and efficient future. Fleet electrification and wireless charging infrastructure deployment are identified as critical steps towards achieving this vision. As we move forward, addressing challenges such as standardization, infrastructure scalability, and cost-effectiveness will be crucial in realizing the full potential of wireless charging technologies. The continued research and development in this field hold the promise of a future where power delivery is not only more efficient and convenient but also more sustainable, revolutionizing the way we power our electronic devices and vehicles.

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Conflict of Interest

None.

References

1. Maglaras, Leandros A., Frangiskos V. Topalis and Athanasios L. Maglaras. "Cooperative approaches for dymanic wireless charging of electric vehicles in a smart city." In 2014 IEEE International Energy Conference (ENERGYCON), IEEE (2014): 1365-1369.
2. Mohamed, Naoui, Flah Aymen, Turki EA Alharbi and Claude Ziad El-Bayeh, et al. "A comprehensive analysis of wireless charging systems for electric vehicles." *IEEE Access* 10 (2022): 43865-43881.
3. Fisher, Taylor M., Kathleen Blair Farley, Yabiao Gao, Hua Bai and Zion Tsz Ho Tse. "Electric vehicle wireless charging technology: A state-of-the-art review of magnetic coupling systems." *Wireless Power Transfer* 1 (2014): 87-96.
4. Mahesh, Aganti, Bharatiraja Chokkalingam and Lucian Mihet-Popa. "Inductive wireless power transfer charging for electric vehicles–a review." *IEEE Access* 9 (2021): 137667-137713.
5. Bagchi, Anindya Chitta, Abhilash Kamineni, Regan Andrew Zane and Richard Carlson. "Review and comparative analysis of topologies and control methods in dynamic wireless charging of electric vehicles." *IEEE Journal of Emerging and Selected Topics in Power Electronics* 9 (2021): 4947-4962.
6. Jang, Young Jae. "Survey of the operation and system study on wireless charging electric vehicle systems." *Transport Res Part C: Emerg Technol* 95 (2018): 844-866.

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