OTP Based Wireless Power Transfer for EV at User Point

Dr. S Ramya[1], Ragaveena A S[2], Lingeswar N[3], Rohini M[4], Raja Sri P[5]
[1]*Assistant Professor, Department of Electronics and Communication Engineering Sri Krishna College of Technology, Coimbatore.*
[2,3,4,5] *Department of Electronics and Communication Engineering Sri Krishna College of Technology, Coimbatore.*

Abstract: **This paper introduces an innovative solution to enhance the efficiency of electrical vehicle (EV) charging. Unlike traditional stationary charging system, this approach uses vehicle-to-vehicle wireless charging technology combined with GPS tracking. Driver can simply use an easy-to-access portal to request charging assistance, which shares their vehicle's exact location with a central service platform to ensure smooth and efficient charging delivery. What makes this idea stand out is the use of wireless charging lanes. These lanes automatically charge vehicles as they drive over them, making it easier for EV owners to extend their range without needing to stop at a station. This not only improves convenience but also encourages more people to embrace electric vehicles by solving one of their biggest challenges-accessible and hassle-free charging. This innovation eliminates the need for frequent stops at static charging stations, extending driving range and reducing reliance on fixed infrastructure. By addressing critical challenges in EV charging, this approach enhances user convenience, encouraging more people to adopt electric vehicles, and creating the way for a more sustainable transportation future.**

Keywords: **Electric Vehicles (Ev's), Wireless Charging, Vehicle-to-Vehicle Charging, GPS tracking, Sustainable Transportation.**

I.INTRODUCTION

The Project at hand is centered around the groundbreaking concept of vehicle-to-vehicle wireless charging facilitated by GPS technology, which allows electric Vehicles (EV) to charge dynamically while on the move. This innovative approach seeks to address the growing need for efficient and accessible charging solutions for the expanding EV markets. The project envisions a user-friendly system that enables EV owners to request charging assistance through a dedicated application, with real-time location tracking ensuring precise service deployment. The integration of wireless charging lanes further distinguishes this proposal from conventional static charging methods, promising extended driving ranges, diminished battery reliance, and heightened battery accessibility for electric vehicles. In this comprehensive introduction, we will explore the wireless charging principle, the necessity for such a system, its advantage ,and the key protocols involved.

Wireless Charging for electric vehicles operates on the principle of inductive power transfer. IT relies on electromagetic fields to transfer energy between two coils, one installed in the EV and the other embedded in the charging infrastructure on the road. This technology excludes the need for physical connectors and cables, offering a more convenient and continuous charging experience for EV owners.

1.1 CONTROL AND COMMUNICATION

To ensure efficient and safe wireless charging, control and communication systems are essential. These systems manage the power transfer process, monitor the charging progress, and facilitate communication between the EV and the charging infrastructure. This communication is critical for safety and efficiency, allowing for real-time adjustments to charging parameters and the exchange of important data. Wireless charging technology has been advancing rapidly, with different standards and power levels emerging to accommodate various vehicle types and charging needs. This technology forms the foundation of the proposed project's dynamic wireless charging system.

1.2 NECESSITY

The growing adoption of electric vehicles is a promising step toward reducing greenhouse gas emissions and achieving a more sustainable transportation sector. However, the widespread use of electric vehicles also presents challenges, most

notably related to charging infrastructure. The necessity for a dynamic V2V wireless charging system is driven by several key factors:

The existing charging infrastructure for electric vehicles, relying heavily on static charging stations, has a drawback. Sometimes, charging stations may be in short supply, making range anxiety and inconveniencing the EV owners. In addition, they sometimes demand specific connectors and adapters, which makes it not compatible. One of the main barriers to adoption is the fear of running out of battery power before getting to a charging station. Dynamic wireless charging can mitigate this anxiety by providing continuous, on-the-go charging and thus extending the driving range of electric vehicles. Extending and maintaining a massive network of traditional charging stations is expensive and takes time. Dynamic wireless charging lanes are integrated into existing road infrastructure and can be more cost-effective and sustainable. Greenhouse gas reduction is an imperative for the world. This contributes to the goal if electric vehicles produce zero tailpipe emissions, but these environmental benefits can be destroyed if the electricity used in charging comes from non-renewable sources. The benefit of wireless charging systems could be strategic placement near renewable energy sources, which in turn would promote sustainable practices.

1.3 CONVENIENCE

One of the primary advantages of electric vehicles is their convenience. Dynamic wireless charging adds another layer of convenience by eliminating the need for manual charging, making it as effortless as refueling a conventional vehicle.

II. LITERATURE REVIEW

According to the journal based on Wireless Power Transfer (WPT) using magnetic resonance is an innovative technology that eliminates the need for traditional charging wires. Ongoing research aims to enhance the efficiency of WPT systems by increasing the transfer distance while maintaining high power efficiency. This project focuses on using WPT to wirelessly charge electric vehicle (EV) batteries. The study optimizes the distance between the transmitter and receiver circuits, analyzing power transfer efficiency at varying distances. It evaluates the current and voltage levels from the input to the output circuits to assess how effectively the power is delivered to the EV battery without any physical connection. This wireless charging system addresses several challenges associated with wired charging, such as the risk of electric shocks, high costs, and inconvenience caused by tangled or damaged cables. The findings highlight the practicality of WPT in EV charging, recording power outputs under different conditions and input levels. These results contribute to solving issues with conventional wired systems and provide insights into making wireless technology more accessible and cost-effective for electric vehicles.

According to the journal based on Design and Implementation of A Wireless Charging System for Electric Vehicles Wireless Power Transfer (WPT) using magnetic resonance is an innovative technology that gets rid of charging wires. Around the clock investigations are conducted in order to improve the performance of WPT systems by enhancing the transferring distance and at the same time keeping the power efficiency level high. This project works with WPT in an effort to assist in wire free charging of electric vehicle (EV) batteries. The study seeks to optimize the distance between the transmitter and the receiver circuits and makes use of power transfer measurements so as to average out the distance of the two units from each other. It measures how effective the power delivery is to the EV battery from the input circuit to the output circuit, where no physical connection exists between the two. This wireless charging system solves a number of problems which are found in wired charging such as electric shock hazards, high costs and issues of damaged or improperly arranged wires or cables. The results emphasize the potential of WPT in the charging of EVs, noting a power output performance under various conditions and input levels. Such results begin to address the problems associated with traditional wired systems and give a sneak preview into Wireless charging for Electric Vehicle which are noticeably more economical and feasible in terms of expansion purposes.

According to the journal based on Electric Vehicles (EVs) have become a major focus in the field of Wireless charging. This paper aims at designing a Wireless Power Transfer System (WPTS) and creating a test device to perform a study of the wireless charging process. Beginning from the principles of operating wireless power transfer systems, the authors research the available technologies. The system that seems more feasible for the prototype considering the physical and power requirements is Resonant Inductive Power Transfer

(RIPT). A controller for the RIPT system has been designed, together with the power converter and compensation networks for the system performance. Some simulations are done to test the system response even before a scale prototype is done. Subsequently, experimental tests are conducted to assess the performance of the designed control techniques. The captured waveforms during the test applications are comprehensively scrutinized in order to give details of performance of the resonant inductive charger as a whole. This paper describes the automatic system for resonance topology based wireless power charging to an electric vehicle (EV). The demonstration of the charging system using the resonance coupling effect and single-ended primary-inductor converter (SEPIC) successfully demonstrates the efficacy of the RIPT system for wireless EV charging applications.

According to the journal based on Static wireless charging has become popular as it allows for charging Electric Vehicles (EVs) without the cumbersome cords; sadly, many of the users of EVs face a similar problem. For one, even if the battery is fully charged, the vehicle still has a limited range and may not be able to operate for long distances without requiring charging. To this limitation, however, dynamic wireless charging has also been introduced, and is believed to be a revolutionary approach. Not only does this method promote the practical range of EVs, but it also, further, allows for the erasure of an additional battery, which tends to add on weight that minimizes vehicle performance. Dynamic Wireless Power Transfer (WPT) allows for charging of electric vehicles (EVs) on the go, which could make plug-in charging or even static wireless charging a thing of the past. With the widespread adoption of this technology, electric vehicles could eventually be battery-less, with power being transmitted to the vehicle in real time. This would completely change the landscape for the automotive industry, leading to lighter, more efficient, and eco-friendly vehicles. The basic concept of, say, charging an electric car without wires includes two distinctive types of coils: the transmitting coil and the receiving coil. In this case, the inductive transmitter coil, mounted on a road or over a charging float, provides the induction area of the receiver coil with power through mutual induction. But this energy transfer, similarly to any dynamic systems' transfer, is affected by the relative position of the coils as well as their mutual spacing.

III.EXISTING SYSTEM

Currently, EV charging is predominantly reliant on stationary charging stations, which can be slow and limited in number, particularly in rural or high demand areas. Existing technologies such as fast-charging stations and battery swapping systems have emerged to address some of these issues; however, they still require drivers to make physical stops, leading to inconvenience and time loss. Additionally, some wireless charging technologies are available but often require specific infrastructure or modifications to the vehicles, limiting widespread adoption. These existing solutions do not fully address the need for a seamless, integrated charging experience while on the move. Vehicle-to-Everything (V2X) communication protocols enable EVs to communicate with other vehicles, infrastructure, and traffic management systems. V2X communication is crucial for ensuring that the dynamic wireless charging process is safe and coordinated with other road users.

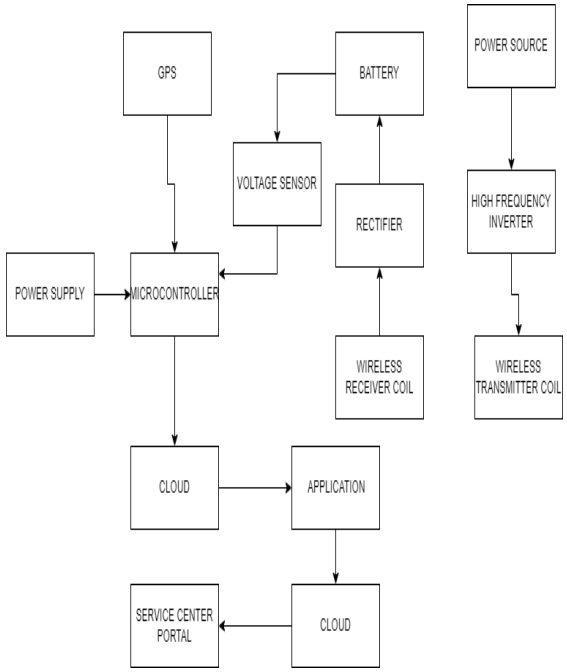
IV.PROPOSED SYSTEM

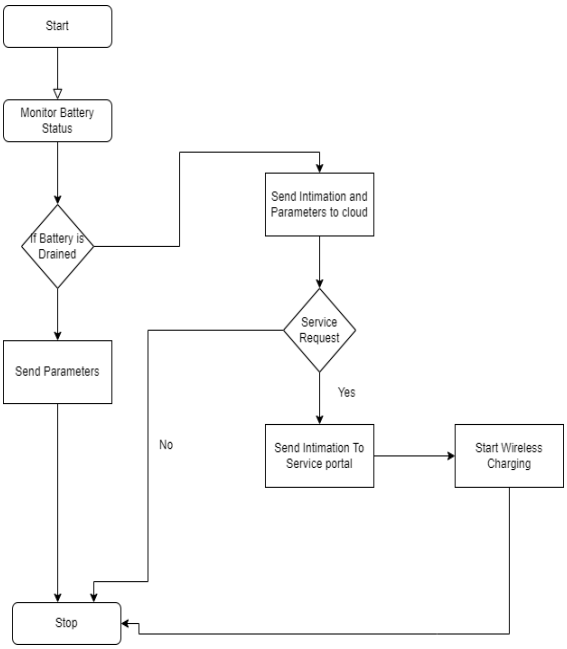
The proposed dynamic wireless charging project aims to revolutionize electric vehicle (EV) charging by implementing a two-system approach: the power transfer system (transmitter) and the receiver system. The receiver system, integrated into the EV, consists of GPS technology, a receiver coil, a voltage sensor, and a Wi-Fi integrated controller. On the other hand, the transmitter system is housed within the service team's vehicle and comprises a high-frequency inverter, a transmitter coil, and a battery. This comprehensive methodology provides a detailed insight into the development, implementation, and operation of this innovative dynamic wireless charging system.

The proposed dynamic wireless charging system, empowered by GPS technology, presents an innovative solution to the challenges facing electric vehicle adoption. It capitalizes on the inductive power transfer principle, offering an extended driving range, reduced reliance on large batteries, and heightened charging accessibility. The necessity for such a system arises from the limitations of traditional charging infrastructure, range anxiety, high infrastructure costs, and the global imperative to reduce emissions. The advantages of dynamic wireless charging include a longer driving range, cost savings, accessibility, flexibility, and environmental benefits. Key protocols, such as SAE J2954, ISO 15118, OCPP, and V2X communication, are essential

to ensuring the safety and efficiency of the system. As electric vehicles continue to gain traction in the market, dynamic wireless charging has the potential to revolutionize the way we power our vehicles, making clean and sustainable transportation a reality for everyone.

V.METHODOLOGY





SYSTEM FLOW DIAGRAM

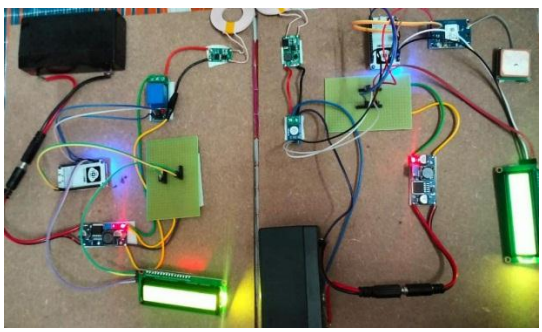
The proposed dynamic wireless charging system, featuring both the receiver and transmitter systems, offers a promising solution to the challenges facing electric vehicle owners, such as limited charging infrastructure and range anxiety. By harnessing the power of inductive power transfer and advanced technologies like GPS, Wi-Fi, and high-frequency inverters, this system aims to make electric vehicle charging more accessible and convenient. It eliminates the need for static charging stations and offers extended driving ranges, reduced battery reliance, and increased charging accessibility. The receiver system, integrated into the electric vehicle, plays a pivotal role in user interaction and location tracking, while the transmitter system in the service team's vehicle is responsible for wireless power transfer. Their close collaboration ensures a seamless and efficient charging experience, making electric vehicles a more practical and sustainable choice for a wide range of users. As electric vehicles continue to gain traction, this dynamic wireless charging system has the potential to revolutionize the way we power our vehicles, contributing to a more sustainable and environmentally friendly transportation sector.

VI. RESULT ANALYSIS

The anticipated results of this project include a functional prototype of the vehicle-to-vehicle wireless charging system, a user-friendly portal for service requests, and a reliable GPS tracking mechanism. Performance metrics will be established to evaluate the efficiency of the wireless charging process, user satisfaction with the system, and the overall impact on driving range. Additionally, a comprehensive report will outline the challenges faced during development and the effectiveness of the proposed methodology.

ALGORITHM	ACCURACY
EXISTING	85
PROPOSED	90

Table 1: Comparison Table



VII. CONCLUSION

In conclusion, the proposed dynamic wireless charging system, which integrates a receiver in electric vehicles and a transmitter within service team vehicles, offers a groundbreaking solution to the challenges of limited charging infrastructure and range anxiety. By utilizing inductive power transfer and advanced technologies like GPS, Wi-Fi, and high-frequency inverters, this system provides a more accessible and convenient charging option. It moves away from static charging stations, extends driving ranges, reduces dependence on batteries, and makes charging more efficient.

VIII. FUTURE WORK

The future scope of the dynamic wireless charging system is exceedingly promising. As electric vehicle adoption continues to grow, the system's potential to eliminate range anxiety, reduce infrastructure costs, and promote sustainable charging practices becomes increasingly significant. Further research and development can lead to advancements in power transfer efficiency, standardized protocols, and the integration of dynamic wireless charging infrastructure into urban planning and transportation network, ultimately accelerating the transition to cleaner and more convenient mobility solution. Additionally, as the technology matures, the prospect of dynamic wireless charging becoming a mainstream feature in electric vehicles and public transportation holds great potential, offering a substantial step forward in sustainable and efficient transportation systems.

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