A Review: Dynamic Wireless Charging of Electrified Vehicles

Shwetha M.S[1], Spoorthi Hirur[2], Shekhar B[3], Pradeep B[4], Sushma J[5]

[1]Assistant Professor, ECE, AIET, Mangalore, India

[2345]UG Scholar, Dept Of ECE, AIET, Mangalore, India

Abstract -- Future innovation is the electric car. The necessity for its popularisation is aided by the reduction of pollution and the utilisation of fossil fuels. The technology used in electric vehicles includes energy storage. The size of the battery, frequent charging, unfavourable meteorological conditions, etc., pose obstacles to the technology's widespread adoption. By offering an alternative method of power transfer to electric vehicles, the initiative seeks to assist the emerging sector of electric vehicles. The wireless magnetic resonance coupling theory underlies the operation of the proposed technology. The system will include specifically constructed highways with underground energised winding. The secondary windings will be located on the vehicle and will effectively link the greatest flux for a smooth and reliable power transmission.

Keywords: - Dynamic wireless Charging, Inductive Power Transfer, Dynamic wireless charging, Electric vehicle.

I. INTRODUCTION

A segmented charging station or a lengthy track that runs the length of the road can both be used with Dynamic Wireless Charging (DWC). A number of wireless charging pad transmitters are placed across the street in segmented charging-based DWC. The range of the Electric Vehicle could be extended with this configuration, but the battery's capacity could be drastically reduced. The cost of installation is decreased because just a portion of the lane needs to be electrified. The primary pads for segmented DWC are distributed throughout the road, while the secondary pads are attached to the Electric Vehicle. It provides the best coupling rate for the primary pad. This will improve system efficiency overall and lower standby losses and EMI emissions. Yet there are certain drawbacks to this technology. For instance, it could be costly and time-consuming.

II. LITERATURE SURVEY

Maglaras *et al* [1] introduces the concept of dynamic wireless charging, which allows power exchange while an electric vehicle is in motion. Currently, parking lots or bus stops are where one may find the fixed charging stations for this technology. Yet, a revolutionary concept known as Mobile Energy Disseminators (MED) has been proposed, allowing for the charging of cars while they are moving or without the usage of trucks or buses. The proposed approach offers a straightforward, affordable, secure procedure with enhanced energy transfer efficiency and a shorter delay in vehicle movement during charging, which addresses the drawbacks of existing methods. Moreover, this procedure reduces environmental contamination. Overall, this abstract highlights the MED approach for dynamic wireless due to its potential benefits.

Patil *et al* [2] in order to enable EVs consume less battery storage, study proposes a novel method for Dynamic Wireless Power Transfer (DWPT) EV detection. The suggested approach comprises identifying the EV before it arrives in order to begin energizing Just-in-time power transfer is made possible by the transmitter that is buried beneath the road. According to the paper, communication can be utilized as a reliable EV detection method at low speeds, but at high speeds, communication lag time becomes an issue. In order to solve this problem, the research offers a low-cost, low-power EV detection system based on a new orthogonal coil arrangement that can recognize EVs travelling quickly. Using simulation in Piecewise Linear Electrical Circuit Simulation (PLECS) and laboratory-scale testing, the study examines the suggested system's functionality.

Buja *et al* [3] for Dynamic Wireless Charging (DWC) for electric vehicles, a lumped track constructed of Double-D coils is used in EVs. Using an analysis employing the finite element approach, this work examines the coupling properties of Double-D coils of various dimensions. Analytical calculations are used to determine the length of the track coil required to deliver the propulsion energy required per unit of travelled space to a moving EV. Using the Double-D coil coupling parameters, the approach calculates the power and energy delivered along the track, from the track coils to the pickup coil. The concept of track flux coverage, or the proportion of coil distance to track coil diameter in the motion direction, is introduced in this study.

Li *et al* [4] describes the drawbacks of dynamic wireless charging, such as the need for secure communication between EVs and utility companies to ensure accurate billing. The current communication alternatives may not be able to handle the huge volume of little messages required for dynamic EV charging. The research proposes a novel method called Fast Authentication for Dynamic EV Charging (FADEC), which aims to fulfil the communication needs of dynamic EV charging while lowering communication overhead and fostering EV mobility. Simulations demonstrate that FADEC is significantly more efficient than the current standard, reducing data delivery delay and increasing data delivery ratio even in situations with constrained resources.

Mohamed *et al* [5] mentioned a general review of the possibilities of Inductive Power Transfer (IPT) technology for recharging EVs, emphasizing its benefits including autonomy, compatibility, safety, and flexibility. Moreover, the ideas behind static, dynamic, and quasi-dynamic wireless EV charging are discussed. The study provides a thorough review of modern transmitter design, compensation networks, power converters, and control algorithms while concentrating particularly on IPT systems in dynamic EV charging. The essay also looks at the challenges and promise of developing dynamic EV inductive charging systems. For scientists and engineers interested in the topic, this study provides information on the most current advancements and unresolved issues.

Leandro’s *et al* [6] primarily focused on the intelligent routing of EVs that require charging to effectively utilize MEDs, which serve as mobile charging stations and disseminate energy. Using graph-based shortest path optimization and constraint logic programming, the suggested routing method eco-routes EVs. According to the report, by utilizing current energy transfer and vehicle communications technology, an electric car's range can be enhanced without the usage of more expensive infrastructure or bigger batteries. The simulations presented in the study show how EVs with intelligent routing may be able to increase their range and trip duration when MEDs are prevalent in metropolitan settings.

Helber *et al* [7] proposed that wireless technology might be applied to improve the sustainability of airport travel operations, with a focus on the apron bus power supply. and the location planning issues connected with the distribution of the system of apron roads contains the required power supply and wireless charging stations. In addition to providing the initial numerical data, the authors also build a formal optimization model. The installation of passenger bus public transportation systems recently on the There may be a use for dynamic wireless charging systems in airport operations on the KAIST campus and in the South Korean city of Gumi. The conclusions of this study can be useful to politicians and airport operators who want to switch to more environmentally friendly ground transportation options.

Laporte *et al* [8] explores the benefits of Wireless Power

Transfer (WPT) as a substitute charging mechanism for EVs. It emphasizes how WPT eliminates the requirement for mechanical contact, such wires or rails, so EVs may charge while they are moving. Also included are recent developments in semiconductor technology that allowed for the first WPT demonstrations in practice. The implementation of a prototype WPT charging infrastructure by VEDECOM and its partners as part of the FABRIC European project is then described in the article. The prototype was evaluated under various real-world driving circumstances, and the system characterization findings are given. Overall, the paragraph demonstrates a successful application of Wireless Power Transfer technology in a real-world setting and gives a quick review of its advantages.

Adil *et al* [9] using a network topological architecture, a hybrid Dynamic Wireless Charging (DWC) method is used for electric cars EVs. The network architecture is built utilizing the improved Destination Sequential Distance Vector (DSDV) protocol, and the proposed method makes use of numerous factors to enable DWC in EVs. The DWC charge between paired EVs is enabled, in order to assess each EV's current charging condition, magnetic coupling and the Charge State Estimator (CSE) are employed as an unsupervised machine learning technique. The suggested method enables each participating EV to transfer charge to another EV participating in the network in a DWC environment. There is a dashboard panel in each participating EV that allows drivers to see the position, distance, and current charge status.

Mohammed *et al* [10] analyses the potential benefits of using shared with an emphasis on using Wireless Power Transfer (WPT) technology to charge the Synchronous Autonoums Electric Vehicle (SAEVs), autonomous electric cars SAEVs are being tested on present city roads. The study suggests a Wireless Charging Infrastructure (WCI) system design optimization tool and technique to support fixed-route SAEVs in Autonomous Mobility Districts (AMDs). The programmer integrates driving data, vehicle parameters, and wireless charger characteristics to create energy and state-of-charge profiles for each automobile. Additionally, it contains a multi-objective optimization layer for choosing the best design parameters in accordance with predefined objectives and restrictions. The study highlights the large investment hurdle that needs to be removed for WCI in order for this technology to be adopted and commercialized.

III. CONCLUSION

In order to reduce range anxiety and enable long-distance driving, DWC a potential technology for EVs, can offer a practical and effective approach to charge EVs while they are moving. DWC systems employ magnetic coupling to wirelessly transfer power from a road-mounted charger to an EV's installed receiving coil. EV fleets, like those of delivery trucks or public buses, can be charged using DWC technology while they are in use, increasing vehicle utilization and lowering environmental impact. The expensive expense of setting up and maintaining the infrastructure, as well as assuring the security and dependability of the charging process, are obstacles that must to be solved.

IV. REFERENCES

[1] Leandro’s A. Maglaras, Jianmin Jiang, Athanasios Maglaras, Francisco’s V. Topalis, and Sotiris Moschoyiannis International Journal of the Advanced Computer Science And Applications, 2014, Volume XXX, Number XXX.

[2] Devendra Patil, IEEE Student Member, John Miller, IEEE Life Fellow, Babak Fahimi, IEEE Fellow And Poras T, Balsara, IEEE fellow And Veda Galigerkere, IEEE Senior Member, A Coil Detection System for the Dynamic Wireless Charging of Electric Vehicle.

[3] Giuseppe Buja, Life Fellow, IEEE, Manuele Bertoluzzo, and Herman K. Dasher Lumped Track Layout Design for the Dynamic Wireless Charging of Electric Vehicles.

[4] Hong Yang Li UIUC hli52, Gorgy D” an’ KTH gyri, Klara Narrated UIUC Klara Fast Authentication for the Dynamic Electric vehicle Charging.

[5] Ahmed A. S. Mohamed1, Ahmed A. Shaier2, Hamid Metwally2, and Sameh I. Selem2 An introduction to electric vehicle dynamic inductive charging.

[6] Leandro’s A. Maglaras 2, Senior Member, IEEE, Michalis Macrounits 3, Sotiris Macrounits 4, Senior Member, IEEE, Route Optimization of Electric Vehicles Based on Dynamic Wireless Charging.

[7] Stefan Helber 1, * ID, Justine Brohan 1 ID, Young Jae Jung 2 ID, Peter Hecker 3 ID And Thomas Federal 3 Location Planning for the Dynamic Wireless Charging System for Electric Airport Passenger Buses.

[8] Stephane Laporte 1, *, Gerard Coquetry 1, Virginie Deneau 2, Alexandre De Bernardines 3 And Nicolas Haughtier 4 Dynamic Wireless Power Transfer Charging Infrastructure for the Future EVs From Experimental Track to Real Circulated Roads Demonstrations.

[9] Muhammad Adil 1, (Student Member, IEEE), Jehad Ali 2, 3, (Member, IEEE), Quitman Hoai ta 4, Muhammad Antique 5, and Tae-Sun Chung 2 A Reliable Sensor Network Infrastructure for Electric Vehicles to Allow the Dynamic Wireless Charging Based on Machine Learning Method.

[10] Ahmed A, S, Mohamed, (Senior Member, IEEE), Andrew Meintz and Lei Zhu National Renewable Energy Laboratory, Golden, Co 80401, USA System Design and Optimization of In-Route Wireless Charging Infrastructure for Shared Automated Electric Vehicles.