SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 7 | July 2024 - Peer Reviewed Journal

AN EFFICIENT EV CHARGING PATH WITHWIRELESS POWER TRANSFER TECHNOLOGY

Sooraj S[1], Muhammed Shibily K[2], Muhammed Salman Rafeek P[3], Ms Ajeena A[4]

[1]Department of Electronics &Communication Engineering, Jawaharlal College of Engineering andTechnology Palakkad, India

[2]Department of Electronics &Communication Engineering, Jawaharlal College of Engineering andTechnology Palakkad, India

[3]Department of Electronics & Communication engineering Jawaharlal College of Engineering andTechnology Palakkad, India

[4]Project Guide& Assistant Professor, Department ofElectronics & Communication Engineering , Jawaharlal College ofEngineering and Technology, Palakkad,India

ABSTRACT

This research proposes an innovative solution forwirelessly charging electric vehicles using dynamic wireless power transfer, which incorporates solar panels for feasible charging. The system relies on resonant inductive power transfer between the coils installed beneath the road surface and a receiver coil placed on the vehicle.An experimental validation was conducted using a hardware setup. The overall system showcases power transmission to charge the vehicle's battery while in motion, eliminating the need to wait for a full battery charge.

I. INTRODUCTION

The gradual deterioration of air quality has popularized electric vehicles as a viable alternative to gasoline powered internal combustion engine (ICE) vehicles. Electric vehicles,equipped with electric motors and high-energy storage devices, offer greater convenience than gasoline- and diesel-powered vehicles. However, the lack of robust charginginfrastructure and high vehicle costs have hindered the rapidgrowth of Electric Vehicles (EVs) in the transportation sector. Various research approaches have been explored in relation to the EV charging methods. Conductive charging involves plugging a cable into an AC source to charge the battery (Budhia et al. 2011). This requires an immediate connection between the power source and the battery. However, this method poses challenges, such as time requirements, determining suitable installation locations, traffic disruptions due to frequent shutdowns, and managinglarge cables connected to EVs (Hul, 2013). Wireless charging offers significant potential for overcoming these limitations (Bolger et al., 1978). It offers advantages such asenhanced safety and ease of charging under stationary or dynamic conditions.

II. LITERATURE REVIEW

A. MODELING AND ANALYSIS OF DYNAMIC CHARGING FOR EVS: A STOCHASTIC GEOMETRY APPROACH

With the increasing demand for greener and more energy efficient transportation solutions,electric vehicles (EVs) have emerged to be the future of transportation across the globe. However, currently,one of the biggest bottlenecks of EVs is the battery. Small batteries limit the EVs driving range, while big batteries are expensive and notenvironmentally friendly. One potential solution to this challenge is the deployment of charging roads, i.e., dynamic wireless charging systems installed under the roads that enable EVs to be charged while driving. In this paper, we use tools from stochastic geometry to establish a framework that enables evaluating the performance of charging roads deployment in metropolitan cities.We first present the course of actions that a driver should take when drivingfrom a random source to a random destination in order to maximize dynamic charging during the trip. Next, we analyze the distribution of the distance to the nearest charging road. This distribution is vital for studying multiple performance metrics such as the trip efficiency, which we define as the fraction of the total trip spent on charging roads.Next, we derive the probability that a given trip passesthrough at least one charging road. The derived probability distributions can be used to assist urban planners and policy makers in designing the deployment plans of dynamic wireless charging systems. In addition, they can also be used by drivers and automobile manufacturers in choosing the best driving routes given the road conditions and level of energy of EV battery.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 7 | July 2024 - Peer Reviewed Journal

B. DYNAMIC RESPONSE CHARACTERISTICS OF FASTCHARGING STATION-EVS ONINTERACTION OF MULTIPLE VEHICLES

In view of the existing problems that multiple vehicles interaction in the selection of fast charging stations for electric vehicles (EVs) and the equalizing the service capability by multiple stations game in station-EVs interaction, a dynamic response strategy of fast charging station-EVs considering interaction of multiple vehicles is proposed. According to this, the charging scheme of EVsand the dynamic service fee of charging stations are decided. Firstly, the charging guidance framework ofstation-EVs interaction is proposed to describe the information flow relationship for vehicle, station, road and intelligent transportation system (ITS). Secondly, in order tomeet the diversified needs of car owners in charging selection, a charging navigation model is established. Considering the impact of dynamic path travel time,a dynamic path selection model of urban road network is established based on the road segment transmission model. Thirdly, in order to accurately analyze the interaction process between vehicles, a charging decision-makingmethod is proposed considering the dynamic evolution of EVs, which reflects the station selection probability of different positions during driving. Fourthly, according to thequeuing time of the charging station, the service fee of the charging station is dynamically adjusted to optimize theservice capacity of the charging station, and the multi-agent stackelberg game model is established by combining the charging station selection of EVs with the dynamic service fee of charging station. Finally, Sioux Falls urban road network system is used as an example to analyze the path selection, dynamic decision of charging station selection andservice fee, and station-EVs interaction strategy. The results show that this method improves the efficiency of electric vehicle charging station searching, guides EVs in the road network to charge orderly,balances the charging loadbetween charging stations and optimizes the service capacity of charging station reasonably.

C. ROUTE OPTIMIZATION OF ELECTRIC VEHICLES BASED ON DYNAMIC WIRELESS CHARGING

One of the barriers for the adoption of electric vehicles(EVs) is the anxiety around the limited driving range. Recent proposals have explored charging EVs on the move, using dynamic wireless charging which enables power exchange between the vehicle and the grid while the vehicle is moving. In this paper, we focus on the intelligent routing of EVs in need of charging so that they can make most efficient use of the so-called mobile energy disseminators (MEDs) which operate as mobile charging stations. We present a method for routing EVs around MEDs on the road network, which is based on constraint logic programming and optimization using a graph-based shortest path algorithm. The proposed method exploits inter-vehiclecommunications in order to eco-route electric vehicles. We argue that combining modern communications between vehicles and state of the art technologies on energy transfer, the driving range of EVs can be extended without the need for larger batteries or overtly costly infrastructure. We present extensive simulations in city conditions that show the driving range and consequently the overall travel time ofelectric vehicles is improved with intelligent routing in the presence of MEDs.

D. BATTERY CHARGING METHOD FOR ELECTRIC VEHICLES FROM WIRED TO ON-ROAD WIRELESS CHARGING.

Recent fossil fuel shortages and global warming related problems have caused a substantial shift from internal combustion engine vehicles towards EVs. This paperexplores the thorough review of battery charging infrastructure from wired connection to on-road wirelesscharging for an EV. The initial part of the paper deals with the wired charging and its power electronics infrastructure. The later portion deals with the wireless charging whereboth static and On-Road types are discussed. Furthermore, various aspects of wireless power transfer are also discussed. The Market scenario and future growth prospects are reviewed and presented in last section of the paper.

E. DYNAMIC WIRELESS ELECTRIC VEHICLE CHARGING SYSTEM

Wireless Power Transfer(WPT) utilizing attractivereverberation is the innovation which could set human free from the irritating wires. Indeed, the WPT embraces a similar essential hypothesis which has just been created for something like 30 years with the term inductive power exchange. Recently WPT innovation is growing rapidly . At kilowatts control level, the exchange separate incrementsfrom a few millimeters to a few hundred millimeters with a lattice to stack proficiency above 90%. The makes the WPT very useful to the electric vehicle (EV) charging applications in both stationary and dynamic chargingsituations. This paper surveyed the advancements in the WPT territory material to EV remote charging. By presenting WPT in EVs, the snags of charging time, range, and cost can be effectively relieved. Battery innovation is never again pertinent in the mass market entrance of EVs. It is trusted that specialists could be supported by the cutting edge accomplishments, and push forward the further improvement of WPT just as the extension of EV.

F. DYNAMIC WIRELESS CHARGINGPERFORMANCE ENHANCEMENT FOR ELECTRIC VEHICLES: MUTUAL INDUCTANCE , POWER TRANSFER CAPABILITY , AND EFFICIENCY

Electric vehicles are becoming more popular as an alternative to conventional gasoline powered vehicles. In order to strengthen charging infrastructure, dynamic wireless charging (DWC) is a promising technology throughwhich the vehicle battery can be continuously charged whilethe vehicle is in motion. The main challenge of the DWC system is to investigate the capability for power transfer with the variation in operating parameters in consideration of enhanced efficiency. This study proposes an innovative

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 7 | July 2024 - Peer Reviewed Journal

approach to improve the performance of dynamic wireless charging systems by investigating the magnetic coupler via finite element analysis, exploring power pulsation and mutual inductances with variations in longitudinal, lateral, and air gap distances as variable factors. In addition to this,efficiency analysis is also explored with respect to the mutual inductance and various compensation schemes. Thesimulation studies are carried out using computer-assisted software, i.e., COMSOL Multiphysics 5.5 and MATLAB version 2022b. Finally, a comparative analysis of power transferred, mutual inductance, and efficiency is presented by the compensation schemes.

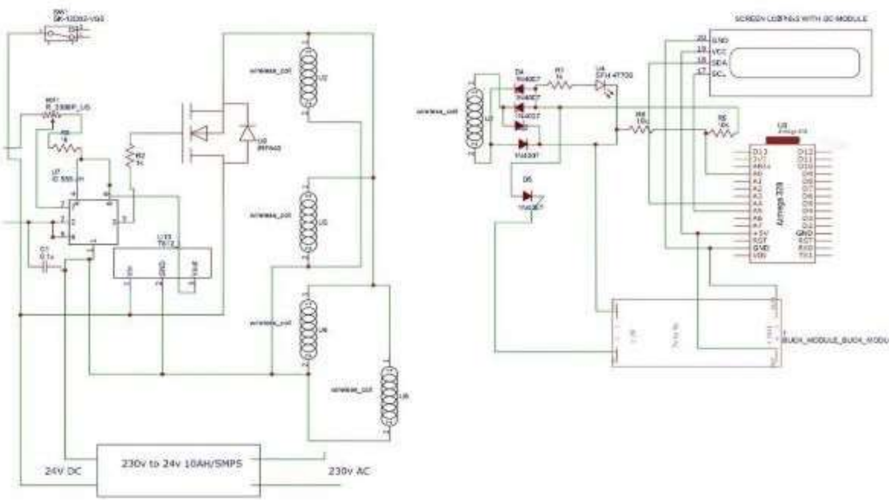
III. METHODOLOGY

This research will assess the feasibility of wireless charging for Electric Vehicles (EVs) via dynamic inductive power transfer. A test system will be built incorporating solar panels for energy replenishment. The system will utilizeresonant inductive coupling between coils embedded under the road and a receiver coil mounted on the underside of the EV. To validate the concept, a hardware setup will be constructed, mimicking a real-world scenario. The experiment will measure the power transfer efficiency whilethe EV simulates motion. This approach will analyze the practicality of in-motion charging, potentially eliminating theneed for stationary charging stations and extended wait timesfor a full battery.

KEY COMPONENETS

1. ATMEGA 328 MICROCONTROLLER
2. SWITCHED-MODE POWER SUPPLY (SMPS)3.BUCK CONVERTER
4. SOLENOID
5. MOSFET
6. LCD DISPLAY
7. MAGNETIC SWITCH
8. A TO D CONVERTER

CIRCUIT DIAGRAM

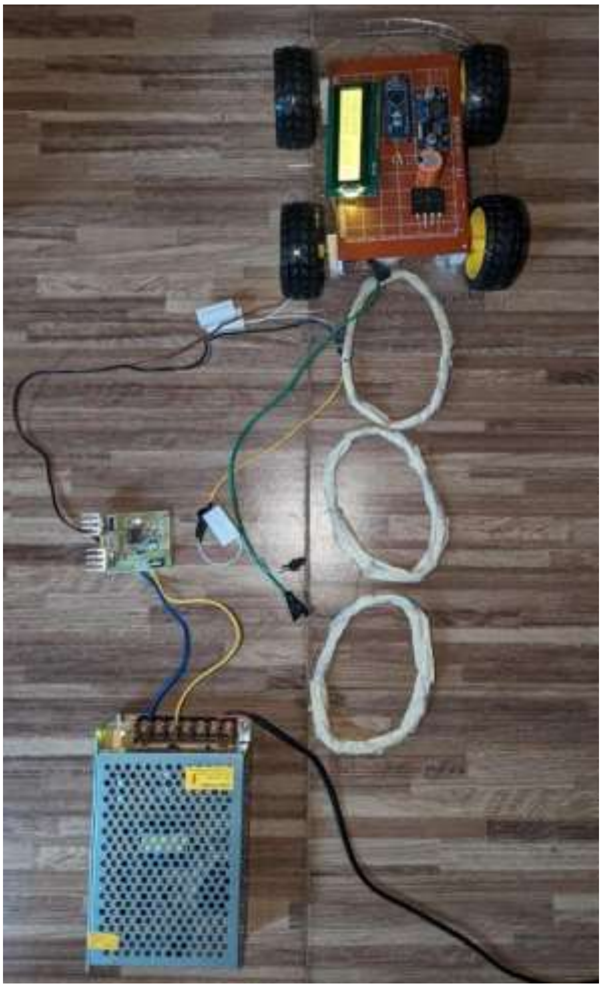


IV. WORKING

Dynamic wireless charging allows electric cars and trucks tocontinuously charge on the go. They receive a constantstream of energy across an air gap while the vehicle is inmotion. A high-frequency inverter is used to generate thealternating magnetic field for transferring electrical energywirelessly to the vehicle using the principle ofelectromagnetic induction. Electromagnetic induction is thecreation of an electro-motive force (EMF) by way of amoving magnetic field around an electric conductor. conversely, the creation of current by moving an electricconductor through a static magnetic field.The powertransfers over the air from a stationary transmitter to thereceiver coil in a moving vehicle. It reduces the need forlarge energy storage which further reduce the weight of the vehicle. Number of Coils : The induced voltage is directlyproportional to the number of turns/coils of the wire. Greaterthe number of turns, greater is voltage produced. ChangingMagnetic Field : This can be done by either moving themagnetic field around the conductor or moving theconductor in the magnetic field.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 7 | July 2024 - Peer Reviewed Journal

IV. WORKING MODEL



V. CONCLUSION

The proposed system offers several advantages, such as eliminating the need for physical connections, reducing carbon emissions, and promoting sustainable transportation.The use of solar energy ensures an eco- friendly and cost-effective solution for EV charging.The implementation of such a system can 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

First and foremost , we would like to thank Ms Ajeena A ,Assistant Professor ,Department of Electronics & Communication Engineering , Jawaharlal College ofEngineering and Technology , for guiding us through the mini project assigned. We would also thank everyone who has helped us thus far with their patience and resources. We acknowledge with extraordinary feelings of joy and a massive sense of gratitude.

REFERENCE

1. *Duc Minh Nguyen , Mustafa A. Kishk and Mohamed-Slim , "Modeling and Analysis of Dynamic Charging for EVs: A Stochastic Geometry Approach" ,IEEE Open Journal of Vehicular Technology , vol. 10 , pp. 17-44 , October. 2020*
2. *Dimitrios Kosmanos , Leandros A. Maglaras , Michalis Mavrovouniotis , Sotiris Moschoyiannis, Antonios Argyriou Athanasios Maglaras and Helge Janicke , "Route Optimization of Electric Vehicles Based on Dynamic Wireless Charging" , IEEE Access , vol. 6 pp. 2169-3536 ,July. 2018*
3. *Kishore Naik Mude , "Battery Charging Method for Electric Vehicles: From Wired to On-Road Wireless Charging" , Chinese Journal of Electrical Engineering , vol. 4, no. 4, pp. 1-14, December. 2018*
4. *Chirag Panchal , Sascha Stegen , Junwei Lu , "Review of static and dynamic wireless electric vehicle charging system" ,Engineering Science and Technology, an International Journal , 21 , pp. 922-937 , June. 2018*
5. *P. Magudeswaran , G. Pradheeba , S. Priyadharshini , M. Sherline Flora , "Dynamic Wireless Electric Vehicle Charging System" ,*

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 7 | July 2024 - Peer Reviewed Journal

IRJET, vol. 6 , Issue 3, pp. 6609-6615 ,March. 2019

6. *Kantipudi V. V. S. R. Chowdary , Kundan Kumar , Byamakesh Nayak , Abhay Kumar and Manuele Bertoluzzo ,“ Dynamic Wireless Charging Performance Enhancement for Electric Vehicles: Mutual Inductance, Power Transfer Capability, and Efficiency” Vehicles , 5 , pp. 1313–1327, 2023.*