**DYNAMIC WIRELESS CHARGING FOR ELECTRIC VEHICLE WITH MULTIPLE ENERGY SOURCES**

**R. Nagasai\*1, T. Vasu\*2, Y. Kiran Naidu \*3, P. Umamaheswara Rao \*4, S.Lavanya\*5 S.Rajavarma\*6 ,K. Harika\*7**

1,2,3,4,5,6,7Department Of Electrical And Electronics Engineering, GMRIT, Rajam, Vizianagaram, Andhra Pradesh, India.

**ABSTRACT**

Addressing problems like range anxiety, lengthy charging periods, and reliance on fossil fuels is crucial as electric cars (EVs) proliferate. By enabling EVs to charge while driving, Dynamic Wireless Charging (DWC) presents a viable alternative to frequent stops and big batteries. This study suggests a smart DWC system that is fueled by a variety of renewable energy sources, including grid-connected energy storage, wind turbines, and solar panels. Advanced power electronics, wireless energy transfer via inductive coils in the road, and a hybrid energy management algorithm that modifies power distribution in real-time according to traffic, vehicle demands, and energy availability are all part of the system. The concept promotes a more resilient and sustainable transportation infrastructure by lowering carbon emissions and dependence on the grid. The design's viability is validated by simulations and prototype testing, which demonstrate improved energy efficiency, reliable charging, and environmental advantages. Future intelligent and environmentally friendly mobility solutions are made possible by this multi-source DWC strategy.

**Keywords:** Dynamic Wireless Charging (DWC), Renewable Energy (Solar, Wind),

Grid-connected Energy Storage, Wireless Power Transfer, Carbon Emission Reduction.

**I.INTRODUCTION**

Because of their improved energy efficiency, lower emissions, and lower running costs, electric vehicles (EVs) are emerging as a major substitute for transportation based on fossil fuels as the world moves toward sustainability. However, issues including few charging stations, lengthy charging periods, and range anxiety continue to impede wider adoption. EV’s can now be charged while driving thanks to Dynamic Wireless Charging (DWC). Wireless power transfer from coils beneath the road to receivers inside the car is accomplished using magnetic resonance or electromagnetic induction. This can significantly increase driving range and decrease the frequency of charging stops, which is particularly helpful for lengthy journeys and commercial fleets. It is crucial to combine several energy sources in order to make DWC more eco-friendly and efficient. Renewable energy sources, such as wind turbines and solar panels, can be employed in place of only depending on the grid. Wind turbines can produce electricity in windy areas, while solar panels can be positioned beside roadways or open spaces. Grid electricity, controlled by a step-down autotransformer to ensure acceptable voltage levels, can take over when renewable energy sources are insufficient. This hybrid strategy makes EV charging more environmentally friendly, guarantees a consistent power supply, and lessens grid strain. Real-time energy flow management is possible with smart grids and Internet of Things technologies, which can optimize power distribution by utilizing data from energy sources and automobiles. Better grid stability, reduced energy waste, and increased efficiency result from this.

# **II. SYSTEM DESIGN**

Describe the design and optimization of the dynamic wireless charging system, including coil design, power electronics, and control systems.

**Coil design:** Design and optimization of transmitter and receiver coils for efficient power transfer, including coil shape, size, and material.

**Power electronics:** Selection and design of power electronic components, such as inverters and rectifiers, for efficient power conversion and transfer.In our project we have used bridge rectifier,mosfet.

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**Figure 1:** Symbol of Mosfet

**Control systems:** Design and implementation of control systems for dynamic wireless charging, including power flow control, energy management, and safety features.

**Energy storage:** Integration and management of energy storage systems, such as batteries or supercapacitors, for efficient energy storage and release.

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**Figure 2:** Rechargable Battery

**III. MODELING AND ANALYSIS**

Optimization of system efficiency, including minimization of energy losses and maximization of power transfer efficiency. Power transfer optimization: Optimization of power transfer, including maximization of power transfer rate and minimization of power transfer fluctuations. Cost optimization of system cost, including minimization of component costs and maximization of system lifespan. Safety optimization: Optimization of system safety, including minimization of electrical shock hazards and maximization of system reliability.

1. **Efficiency Optimization:**

Efficiency optimization focuses on enhancing system performance by minimizing energy losses and maximizing power transfer efficiency. By reducing resistive losses, electromagnetic interference, and unnecessary energy dissipation, it ensures sustainable energy utilization for electric vehicles. Techniques such as improved coil design, adaptive control strategies, and materials with high conductivity contribute to achieving optimal efficiency. The system dynamically adjusts power transmission rates to suit varying vehicle speeds and road conditions. Additionally, incorporating smart energy management algorithms further optimizes power flow and supports reliable operations. These efforts collectively aim to ensure an eco-friendly, cost-effective, and high-performing wireless charging syste

**II. Power transfer optimization**

Power transfer optimization aims to stabilize and maximize the rate of power delivered during dynamic wireless charging. It involves regulating voltage levels, minimizing fluctuations, and ensuring consistent energy flow despite environmental or vehicular variations. Techniques such as load balancing, frequency tuning, and resonant coupling improve the quality of power transfer. Multiple-source integration facilitates seamless transitions between charging stations, avoiding interruptions in power delivery. The focus lies in achieving high transfer efficiency without compromising system reliability. By addressing challenges like misalignment and interference, the optimization ensures uninterrupted charging for electric vehicles, empowering the adoption of clean energy transportation solutions.

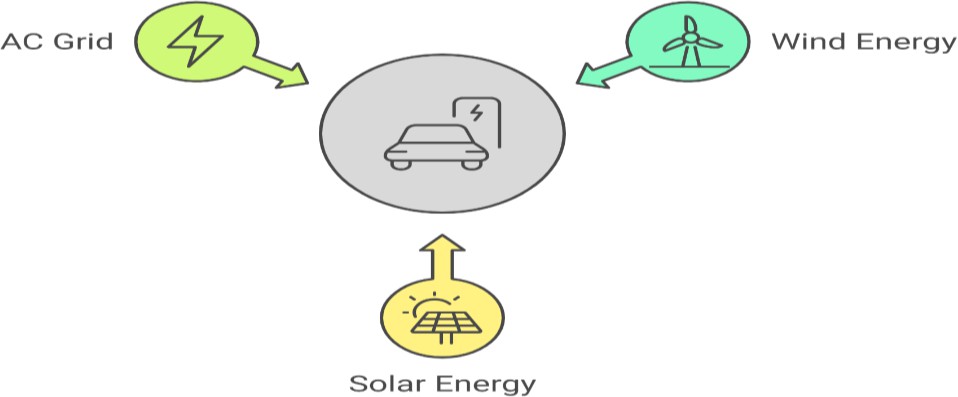
**III. Cost Optimization:**

Cost optimization balances affordability and durability in dynamic wireless charging systems for electric vehicles. It reduces initial component costs by employing innovative designs, affordable materials, and scalable manufacturing techniques. The system lifespan is extended through durable components and minimal maintenance requirements, providing long-term cost savings. Strategies include modular designs for easy upgrades and cost-efficient repairs. Lifecycle cost reduction is achieved by integrating renewable energy sources and enhancing system efficiency, thereby lowering operating expenses. Cost optimization ultimately makes the technology economically viable, promoting widespread adoption and contributing to sustainable transportation solutions without compromising quality or performance.

1. **Safety Optimization**

# Safety optimization ensures secure and reliable operations in dynamic wireless charging systems. It minimizes electrical shock hazards through advanced insulation, grounding, and fail-safe mechanisms. The system incorporates real-time monitoring for fault detection and preventive measures against overheating or short circuits. Reliability enhancement techniques, such as robust material selection and redundant system designs, further elevate safety standards. Additionally, electromagnetic compatibility safeguards against harmful radiation exposure, ensuring compliance with health regulations. By addressing safety concerns comprehensively, the system provides peace of mind for users, paving the way for wider acceptance of dynamic wireless charging as a dependable solution for electric vehicles.

# **IV. MULTIPLE ENERGY SOURCES INTEGRATION**



**Figure 3:** Different energy sources

**Energy Source Selection:**

Energy source selection is crucial for dynamic wireless charging systems, ensuring a stable and sustainable power supply. Multiple sources, such as solar, wind, and grid power, can be integrated to enhance reliability and efficiency. Hybrid energy models enable seamless transitions between sources, optimizing utilization based on availability and demand. Advanced algorithms determine the most effective source in real time, minimizing dependency on a single energy type. Incorporating renewable sources reduces environmental impact while maintaining cost-effectiveness. Intelligent source-switching strategies further refine system performance, supporting continuous power delivery for electric vehicles without compromising efficiency or sustainability.

**Energy Management:**

Energy management strategies ensure smooth operation of multiple energy sources, facilitating energy storage and controlled release to maintain system stability. Smart storage solutions balance surplus power, optimizing energy flow for real-time charging needs. Adaptive algorithms dynamically regulate energy distribution, preventing inefficiencies and power wastage. Battery management systems help mitigate charging fluctuations, extending lifespan and reliability. By integrating predictive load balancing, vehicles receive consistent power without interruptions. Efficient scheduling of energy release ensures that charging demand is met while minimizing stress on individual power sources, fostering a well-coordinated energy management framework for uninterrupted electric vehicle charging.

**Power Flow Control:**

Power flow control optimizes the distribution and regulation of energy from multiple sources to an electric vehicle, minimizing fluctuations and improving efficiency. Advanced control mechanisms enable stable power delivery, adapting to changing road and vehicle conditions. Voltage regulation, impedance matching, and resonant circuit designs mitigate power losses and enhance transfer rates. Load-adaptive control systems ensure that each energy source contributes proportionally, avoiding excessive strain. Effective management of electromagnetic coupling strengthens transfer reliability. By refining power flow strategies, dynamic wireless charging systems provide electric vehicles with smooth, uninterrupted energy supply, supporting real-time adaptation to driving demands.

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# **V.CONCLUSION**

A revolutionary answer to some of the most important issues facing electric vehicles, including range anxiety, a lack of adequate charging infrastructure, and reliance on fossil fuels, is provided by the suggested Dynamic Wireless Charging (DWC) system, which is powered by several renewable energy sources. The system guarantees a steady, effective, and environmentally responsible power supply by combining solar, wind, and grid-connected energy storage. Smooth energy transfer to moving vehicles is made possible by the use of inductive coils embedded in highways, optimised power electronics, and real-time control algorithms, which improve system performance and user convenience. The design provides a dependable, scalable, and sustainable charging infrastructure by utilising sophisticated optimisation techniques that prioritise efficiency, power transmission, cost, and safety. The system's capacity to sustain steady energy flow, lower carbon emissions, and facilitate long-distance travel without frequent pauses or significant battery requirements is confirmed by simulation and prototype testing. In the end, this multi-source DWC method greatly advances the goal of robust, intelligent, and sustainable transportation systems by laying the groundwork for the future generation of smart mobility.

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