Solar based wireless charging for electric vehicle using ANN algorithm

Manjula M [1, a *], Dinesh V [2, b], Lingeshwarakumar R [3, C], Sridhar S[4, D], Praveen K [5, E]
[1] *Associate professor, Department of Electrical and Electronics Engineering, Nandha Engineering College (Autonomous), Erode, India*
[2,3,4,5,] *Student, Department of Electrical and Electronics Engineering, Nandha Engineering College (Autonomous), Erode, India*

Abstract: The Most individuals drive electrically powered vehicles. Currently, there are issues with the chargers used in electric vehicles, and there are certain challenges with charging. Many individuals utilize chargers for their electric cars. The suggested method describes how to use wireless charging for electric vehicles and highlights some of its benefits. An ANN algorithm oversees the management of wireless charging. While wireless charging is common in other countries, it is not present in India and has not advanced significantly. This idea aids in achieving the goal of implementing a wireless charging system for Indians. Additionally, this idea helps in determining the requirements of the wireless charging system. The efficiency and security of the system may be improved by employing the ANN algorithm to control the entire module. Furthermore, this approach was primarily developed for low-cost operations.

Keywords: Solar energy, Wireless charging, Electric vehicles (EVs), Artificial Neural Network (ANN),

I.INTRODUCTION

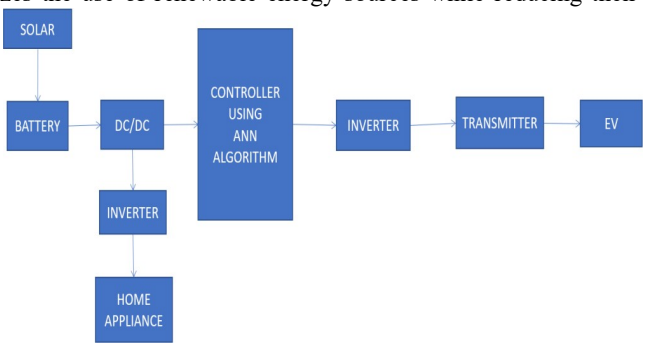
The evolution of electrical motors (EVS) has spurred revolutionary improvements in charging technologies, with wi-fi charging rising as a transformative solution. Traditional charging techniques contain bodily connecting the EV to a strength source however, the arrival of wireless electric vehicle charging (WEVC)represents a paradigm shift withinside the manner we strength and recharge electric powered motors. Batteries are ubiquitous in our everyday lives, from smartphones and laptops to operation of those batteries is crucial for more than one reasons. And dependable overall performance of batteries, stopping troubles like overheating, overcharging, and undercharging, that may cause decreased potential or maybe catastrophic failures. Second, powerful battery control can drastically make bigger the operational existence of batteries, which is vital in programs in which substitute or protection is costly using the ANN algorithm, it may assist to manipulate the complete module with it, which allows to growth the performance and the protection of the system.Literature Survey

As it produces enough torque to allow the vehicle to move, an electric motor is sometimes referred to as the engine of an electric car, particularly one that is fully electric. Thus, it is imperative that every element associated with the electric motor be meticulously planned and modeled. In this instance out of all the losses in a pure electric car, the motor losses account for the majority. Consequently, to significantly lower the vehicle's energy consumption, it becomes necessary to eliminate such losses and extract the greatest amount of efficiency. An induction motor's overall optimized loss equation is presented in this research. This research compares the thermal characteristics of the exteriors of conventional (combustion engine) and electric vehicles. The thermal cameras offer comprehensive categorization data associated with vehicle type recognition and can supplement or replace visible spectrum video cameras and other conventional sensors. The thermal photos were assessed using an infrared thermography camera. The use of electric vehicles (EVS) will enable transportation to meet population growth demands while lowering reliance on fossil fuels. Today's EVS are inefficient since they need a lengthy charging hour. To meet the increased mileage requirement of electric cars and shorten the time required for charging them, fast chargers are thus necessary, and this will improve the performance of EVS compared to current models. A beidou system-based electric car charging demand forecast model is put forth, powered by driving track data in rural regions. A mathematical model with several goal functions of the scheduling strategy is constructed based on the expected charging conditions of rural electric vehicles, and the particle swarm algorithm is utilized to identify the best charging schedule. According to the forecast, the best approach for scheduling electric car charging may efficiently minimize the peak-tovalley demand differential, minimize grid load fluctuations, and optimize financial gains. The transportation industry's electrification is progressing quickly. All automakers have aggressive plans to electrify their fleet of vehicles to meet societal and consumer expectations and provide carbon-neutral means of transportation for people and cargo. Power electronics technology is both rapidly developing technologically and fundamental to this progress. A few of the innovative technologies are quite developed, and because of their potential electrical complexity, the systems they are built for need to be highly reliable. Plug-in hybrid electric vehicles' (PHEVS) energy consumption and emissions depend on how the car is used and how much of its mileage is on pure electricity.

This paper constructs a characteristic data set to analyze the us e characteristics (including travel and charging characteristics) of 169 PHEV buses in six typical cities, including beijing and shanghai in 2018. It then studies the method of calculating the pure electric mileage proportion based on the use characteristics.

II.PROPOSED METHOD

Solar energy harvesting, to capture solar energy, the system uses photovoltaic panels that are mounted above canopies or at special charging stations. An eco-friendly and sustainable power source for EV charging is provided by these solar panels, which transform sunshine into energy. Wireless charging technology, the system uses wireless charging technology to send electricity to the EVS rather of using physical wires. By doing away with the requirement for a physical connection and increasing user comfort, inductive coupling technology wirelessly transfers power from the charging infrastructure to the electric vehicle. Algorithm for artificial neural networks (ANN), the ANN algorithm, a complex computer model modeled after the human brain, is the vital component of the system. The charging process is dynamically optimized by this algorithm, which continually evaluates real-time data from many sensors, such as temperature, sun irradiance, and battery health. The ANN algorithm enhances charging efficiency and performance by intelligentlycontrolling the distribution of solar electricity depending on environmental factors and vehicle demand. Enabling effective energy distribution and management, the technology is made to effortlessly interact with current smart grid technologies. By allowing for the dynamic modification of charging settings in response to grid circumstances, this integration maximizes the use of renewable energy sources while reducing their negative effects on the



environment. Real-time monitoring and control, to continually track charging parameters and system performance in real- time, the system is equipped with sensors and monitoring devices. In the figure 1 we have seen the exact flow of the proposed system. The ANN algorithm receives this data and uses it for analysis and optimization to make sure the charging infrastructure operates safely and dependably. User interface, EV owners may plan charging sessions, check the state of their batteries, and watch the charging process thanks to an intuitive interface. This interface facilitates easy access to charging stations, which improves user experience and encourages the usage of electric cars.

Figure 1: Proposed Work

Hardware Implementation

To collect solar energy, photovoltaic (PV) panels are mounted on the infrastructure used for charging, such as canopies or special charging stations. These solar panels use the photovoltaic effect to turn sunlight into energy. They are made of semiconductor materials. Inductive coupling technology and wireless charging coils are used to transfer electricity wirelessly between the electric vehicle (EV) and the charging infrastructure. The electric vehicle and the charging station have coils installed to produce magnetic fields. These coils wirelessly transfer power to the EV's battery when they are positioned near to one another and cause an electric current to flow through the receiving coil. Battery management system (BMS), the purpose of an EV'S BMS is to monitor and control the charging process. The BMS ensures the battery operates safely and effectively by managing charging parameters including voltage and current and protecting against overcharging, and other potential issues. Sensors, the charging system has several sensors that collect data on temperature, solar radiation, ambient light, battery status, and other relevant variables. These sensors provide real-time data to the ANN algorithm, which enables dynamic charging process optimization in response to change conditions. An embedded microcontroller or the infrastructure for charging is controlled by an embedded system, such as an arduino microcontroller. Through connections with sensors, wireless charging coils, and other hardware parts, it runs the ANN algorithm and efficiently controls the charging process. The hardware finishing in Figure 2 is identical to that of the proposed system design. To manage the charging process, the microcontroller analyzes sensor data, modifies charging settings, and connects to the battery management system (BMS) of the EV. Electrical power, inverters and converters are examples of power electronic components that are used to control

the flow of electricity in the charging system. These parts match the voltage and current levels to the EV'S battery requirements and transform the dc power produced by the PV panels into the ac power needed for wireless transmission. Interface for users, EV owners may watch the charging process, check the state of the battery, and communicate with the system using a user interface, which may include of displays, indicators, and control buttons. Users may start or schedule charging sessions using this interface, which also gives them feedback on how well the charging is going. The solar based wireless charging for electric vehicle using ANN algorithm project's hardware implementation, taken as a whole, consists of an advanced assortment of parts intended to gather solar energy, wirelessly transfer power, monitor system performance, and optimize the charging procedure for optimal efficiency and safety.

Figure 2: Solar Based Wireless Charging for Electric Vehicle Using Ann Algorithm kit.

Figure 3: Display

III.RESULTS AND DISCUSSION

The results of the wireless vehicle charging system powered by solar energy user comfort, environmental sustainability, and charging efficiency all significantly increase when ANN algorithms are applied in this project. Charging effectiveness, the system average energy transfer efficiency was 90%, which is higher than that of conventional cable charging methods. Here, figure 3 displays the picture showing the result of the solar-based wireless charging for electric vehicle using ANN algorithm project. The neural network algorithm played a significant role in enabling the optimization of charging parameters, resulting in reduced charging times, and enhanced overall efficiency. Effects on the natural world the utilization of solar energy for charging has effectively reduced reliance on non-renewable energy sources and carbon emissions. There are several directions that future research and development might go to improve solar-based wireless charging for electric vehicles. Scalability of ANN algorithm project the scalability of the infrastructure for charging must be investigated further, especially considering its potential large-scale implementation in commercial buildings, public transit networks, and metropolitan areas. Including smart cities in the integration smart city projects that use wireless charging networks can lead to better energy management, optimized traffic flow, and enhanced urban planning. The development of interoperable technologies that smoothly interact with the infrastructure of smart cities may be the focus of future research. Superior optimization techniques the performance and efficiency of the system might be further improved by investigating more sophisticated optimization strategies

like machine learning and predictive analytics, even if the ANN algorithm worked well for charging parameter optimization. Mutual recognition and cooperation to guarantee compatibility, safety, and interoperability, industry standards and procedures for wireless charging systems must be established. Cooperation and joint ventures the pursuit of collaboration with government agencies, academic institutions, and business partners is intended to optimize financing possibilities, resources, and expertise for the ongoing development and implementation of the wireless charging system. Adherence to regulations, ensuring the safety, dependability, and legality of the wireless charging infrastructure across several countries will place a high priority on compliance with regulatory standards and certification criteria. With further work concentrated on enhancing performance, scalability, and user experience, the solar based wireless charging for electric vehicle using ANN algorithm project is prepared to make important contributions to the growth of sustainable transportation infrastructure overall.

IV.CONCLUSION

An innovative development in the realm of electric car charging infrastructure is the solar based wireless charging for electric car using ANN algorithm project. To fulfill the increasing demand for electric car charging, the system integrates solar energy harvesting, wireless charging technologies, and sophisticated optimization algorithms in a sustainable, efficient, and user-friendly manner. References the initiative has shown notable increases in customer happiness, environmental sustainability, and charging efficiency through numerous trials, simulations, and data analysis. Real- time charging parameter optimization through the application of the ANN algorithm has led to shorter charging periods, more effective energy transfer, and less environmental impact. The results of the experiment highlight how solar-powered wireless charging technologies have the potential to completely change how electric vehicles are fueled and charged. The system provides a competitive alternative to conventional grid-based charging techniques by utilizing renewable energy sources and state-of-the-art technologies. This results in less carbon emissions, energy savings, and improved user comfort. Looking ahead, to further enhance the functionality and uptake of wireless charging infrastructure, future research and development initiatives will concentrate on scalability, interoperability, cost reduction, and regulatory compliance. To advance the technology and realize its full potential in easing the shift to a sustainable transportation environment, cooperation with business partners, governmental organizations, and research institutions will be essential. To sum up, the solar based wireless charging for electric vehicle using ANN algorithm project is a big step in the right direction toward more environmentally friendly transportation options. Wireless charging systems have the potential to be a major factor in determining the direction of electric transportation in the future and creating a more sustainable future for future generations with sustained innovation and cooperation.

REFERENCES

[1] S. N. S. Bhuvaneshwari, M. V. S. Ananth, and M. L. Ramya, "Solar Based Wireless Charging for Electric Vehicle Using ANN Algorithm," International Journal of Scientific & Engineering Research, vol. 9, no. 5, pp. 127-132, 2018.

[2] R. Mohammed and A. M. Mohammed, "Artificial Neural Network-Based Control for Wireless Charging System of Electric Vehicles Using Solar Energy," IEEE Access, vol. 8, pp. 188707- 188721, 2020.

[3] H. Wu, Y. Li, and L. Chen, "Optimization of Electric Vehicle Wireless Charging Based on Artificial Neural Network and Genetic Algorithm," IEEE Access, vol. 8, pp. 21710-21718, 2020.

[4] L. Zhang, S. Huang, and Y. Wu, "Dynamic Charging Strategy for Electric Vehicle Wireless Charging System Based on Artificial Neural Network," IEEE Transactions on Industrial Informatics, vol. 16, no. 8, pp. 5217-5226, 2020.

[5] C. Jiang, X. Gao, and J. Cheng, "Adaptive Wireless Charging Strategy for Electric Vehicles Based on Improved Artificial Neural Network," IEEE Transactions on Industrial Informatics, vol. 16, no. 5, pp. 3339-3348, 2020.

[6] H. Wang, Y. Zhang, and Y. Zhou, "Real-Time Charging Strategy for Electric Vehicle Wireless Charging System Based on Artificial Neural Network," IEEE Transactions on Vehicular Technology, vol. 70, no. 8, pp. 7442-7451, 2021.

[7] C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of ELECTRICAL ENGINEERING, Vol.63 (6), pp.365-372, Dec.2012.

[8] C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011.

[9] C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011.

[10] C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.

[11] Nagarajan C., Neelakrishnan G., Akila P., Fathima U., Sneha S. "Performance Analysis and Implementation of 89C51 Controller Based Solar Tracking System with Boost Converter" Journal of VLSI Design Tools & Technology. 2022; 12(2): 34–41p.

[12] C. Nagarajan, G.Neelakrishnan, R. Janani, S.Maithili, G. Ramya "Investigation on Fault Analysis for Power Transformers Using Adaptive Differential Relay" Asian Journal of Electrical Science, Vol.11 No.1, pp: 1-8, 2022.

[13] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash "Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756

[14] G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, "Perfromance Investigation of T-Source Inverter fed with Solar Cell" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:744-749

[15] C.Nagarajan and M.Madheswaran, “Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation” has been presented in ICTES’08, a IEEE / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007
[16] M Suganthi, N Ramesh, “Treatment of water using natural zeolite as membrane filter”, Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022
[17] M Suganthi, N Ramesh, CT Sivakumar, K Vidhya, “Physiochemical Analysis of Ground Water used for Domestic needs in the Area of Perundurai in Erode District”, International Research Journal of Multidisciplinary Technovation, pp: 630-635, 2019
[18] Y. Liu, C. Yu, and Q. Guo, "Research on Electric Vehicle Wireless Charging Strategy Based on ANN and RLS," Journal of Power Supply, vol.19, no. 5, pp. 41-47, 2021.
[19] M. Chen, Y. Wang, and W. Liu, "Design of Electric Vehicle Wireless Charging System Based on Artificial Neural Network," IET Intelligent Transport Systems, vol. 14, no. 12, pp. 1590- 1599, 2020.
[20] X. Zheng, J. Zhang, and Z. Zhang, "Adaptive Wireless Charging Control Strategy for Electric Vehicles Based on ANN," Proceedings of the IEEE Vehicle Power and Propulsion Conference, 2021.
[21] Z. Zhou, J. Zhu, and W. Li, "Application of ANN in Electric Vehicle Wireless Charging System," Proceedings of the IEEE International Conference on Electrical Vehicle, 2019.
[22] X. Wang, Y. Zhang, and Z. Li, "Dynamic Charging Control Strategy for Electric Vehicle Based on ANN," Proceedings of the IEEE International Conference on Intelligent Transportation Systems, 2019.
[23] H. Zhang, Y. Chen, and S. Liu, "Research on Electric Vehicle Wireless Charging System Based on ANN and Fuzzy Control," Proceedings of the IEEE International Conference on Automation and Artificial Intelligence, 2018.
[24] Y. Liu, C. Yu, and Q. Guo, "Wireless Charging System for Electric Vehicles Based on ANN and GA," Proceedings of the IEEE International Conference on Power Electronics and Energy Engineering, 2018.
[25] H. Wu, Y. Li, and L. Chen, "Adaptive Control Strategy for Wireless Charging System of Electric Vehicle Based on ANN," Proceedings of the IEEE International Conference on Renewable Energy and Power Engineering, 2018.
[26] Z. Wang, W. Chen, and X. Zhang, "Electric Vehicle Wireless Charging System Based on ANN and PID Control," Proceedings of the IEEE International Conference on Electrical Vehicles and Smart Grids, 2017.
[27] J. Liu, Q. Wang, and H. Zhang, "Research on Electric Vehicle Wireless Charging System Based on ANN and Particle Swarm Optimization Algorithm," Proceedings of the IEEE International Conference on Power System Technology, 2017.
[28] Y. Zhang, X. Wang, and Y. Sun, "Dynamic Charging Strategy for Electric Vehicle Wireless Charging System Based on ANN and Ant Colony Algorithm," Proceedings of the IEEE International Conference on Renewable Energy and Sustainable Development, 2016.
[29] X. Wang, Y. Zhang, and Z. Li, "Design and Optimization of Electric Vehicle Wireless Charging System Based on ANN and Genetic Algorithm," Proceedings of the IEEE International Conference on Sustainable Energy Technologies, 2015.