Wireless Solar Based EV Charging Lane

Prof. Aabhale B.A[1], Kukker Vinayak[2], Gaikwad Sarvesh[3], Shinde Yashraj[4], Kshatriya Archit[5]

Department of Information Technology
SND College of Engineering & Research Center, Yeola, Maharashtra, India

Abstract
As the demand for electric vehicles (EVs) surges, so does the need for efficient charging solutions, especially in workplaces. This paper delves into the feasibility of implementing a solar-powered wireless charging system for EVs in the Netherlands. Utilizing inductive coupling, the system eliminates the need for physical cables, enabling seamless charging by simply parking the vehicle at designated spots. Drawing inspiration from Nikola Tesla's groundbreaking concept of wireless power transmission, this project integrates Internet of Things (IoT) technology for streamlined payment processes. Through RFID tags, users can conveniently settle their charging fees without human intervention. The IoT infrastructure ensures efficient monitoring of balances and updates, ensuring a hassle-free experience. By combining solar energy, wireless charging, and IoT, this project presents a promising step towards the future of sustainable transportation infrastructure.

***Keywords*: Electric vehicle (EV) - Wireless charging - Solar energy - Netherlands - Inductive coupling - Nikola Tesla - Internet of Things (IoT) - RFID - Sustainable transportation - Future technology.**

INTRODUCTION

The burgeoning adoption of electric vehicles (EVs) has underscored the imperative for robust charging infrastructure, particularly in workplaces. This paper explores the viability of implementing a solar-powered wireless charging system for EVs within the Netherlands. Leveraging inductive coupling technology, this system obviates the need for physical connections, enabling effortless charging by merely parking the vehicle at designated locations. Inspired by Nikola Tesla's revolutionary concept of wireless power transmission, this project integrates Internet of Things (IoT) technology to streamline payment processes. Through Radio-Frequency Identification (RFID) tags, users can conveniently settle charging fees without human intervention. The IoT framework ensures efficient balance monitoring and updates, ensuring a seamless user experience. By amalgamating solar energy, wireless charging, and IoT, this project presents a promising stride towards the future of sustainable transportation infrastructure.

With the escalating demand for sustainable transportation solutions, the Netherlands has emerged as a frontrunner in promoting EV adoption and renewable energy integration. The proliferation of EVs necessitates innovative charging solutions that are not only efficient but also environmentally friendly. Solar-powered wireless charging systems offer a compelling proposition by harnessing clean energy sources and eliminating the need for cumbersome cables, thereby reducing infrastructure complexity and enhancing user convenience. Furthermore, the integration of inductive coupling technology enhances safety and reliability, minimizing the risk of electrical hazards and ensuring seamless charging experiences for EV owners.

Moreover, the incorporation of IoT technology adds a layer of intelligence to the charging infrastructure, enabling automated payment processes and real-time monitoring capabilities. By leveraging RFID tags, users can effortlessly manage their charging transactions without the need for manual intervention, enhancing operational efficiency and user satisfaction. The IoT-enabled system facilitates data-driven insights into charging patterns, energy consumption, and infrastructure utilization, empowering stakeholders to optimize resource allocation and enhance system performance. Overall, the convergence of solar energy, wireless

charging, and IoT technologies presents a holistic approach to advancing the EV charging ecosystem, driving sustainability and innovation in the transportation sector**.**

LITURATURE SURVEY

Khalid MOHAMED; Henok K. WOLDE; Salma M. S. Optimal Space Utilisation for Solar Powered EV Charging Station, 2020 6th IEEE International Energy Conference (ENERGYCon), The transport sector continues to be the greatest contributor to the alarming emission levels. In fact, today more than ever, people favor the use of passenger vehicles over public transport to avoid contact with coronavirus. Carbon savings made across the sectors during the global lockdown to control the spread of the novel COVID-19 virus are therefore at a great threat. This necessitates the need for sustainable transition to an ultra-low carbon transportation system. Although, electric vehicles enablement continues to aid with transition, the sustainability of the fuel poses greater risks for pollution shifting. In this paper an DC microgrid EV charging solution powered by renewables is explored through MATLAB and HOMER simulation. A realistic approximation to carpark special constraints is calculated and a solar PV system in both S-shape and M-shape configurations is modelled. The analysis for efficient space utilisation is based on sun path data and weather conditions in the city of Leeds for a constant peak load of 10 EVs. As well as, an alternative in the form of a small wind turbine is compared with photovoltaics for a single charging station.

Seoeun Rho; Myeongseok Chae; Dongjun Won, Forecast-based Optimal Operation of EV Charging Station with PV Considering Charging Demand and Distributed System, 2024 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT): In this paper, based on forecasting short-term PV generation, demand, and EV charging, we propose a forecast-based optimal V2G scheduling strategy of Energy management system for minimizing the operating cost of an EV charging station and increasing the use of renewable energy. The significance of the developed method is constructing the detailed forecast model consisting of PV generation, regional load demand, and EV charging demand and analyzing the effectiveness of the scheduling participation rate in the case study. Demand types of office and residential areas were considered to establish a realistic EV charging station operation scheme, and short-term electricity demand forecasts were made based on EV charging data. By integrating these various data, efficient power management is possible. The forecast-based scheduling results show that PV self-consumption has increased, and the main grid dependence and operating cost have decreased..[2].

Berke Can Hasdemir; Dilber Acikgoz; Gokturk Poyrazoglu, A Stochastic Simulation for a Hybrid System of Solar Panels and EV Chargers, 2020 2nd Global Power, Energy and Communication Conference (GPECOM In line with the increasing number of electric vehicles, a stochastic approach that simulates the charging stations which is managed hybridlike system of a solar array is discussed in this study. A smart charging system algorithm is designed to control the charging status of electric vehicles arriving at a parking lot with a certain vehicle capacity based on the real data. Since charging electric vehicles can become an extra burden on the power grid, a smart charging algorithm is needed for stability and security. By solar energy, electric vehicles can be charged, and the surplus can be injected back to the grid. Otherwise, electricity can be provided from the grid. A stochastic-based simulation is developed to generate the necessary big-data based on realistic assumptions. The installation parameters of the solar energy, the number of vehicles in the parking lot, the hours of arrival, the duration of stay, and the charging status are simulated in various scenarios. This research aims to meet the demand for the increasing number of electric vehicles with the smart charging algorithm in the areas where have high solar energy potential.

OBJECTIVES

1. Evaluate the feasibility of implementing a solar-powered wireless charging system for electric vehicles (EVs) in workplace environments within the Netherlands.
2. Investigate the technical viability and efficiency of inductive coupling technology for wirelessly charging EVs, emphasizing safety, reliability, and user convenience.

3. Integrate Internet of Things (IoT) technology into the charging infrastructure to facilitate automated payment processes and real-time monitoring of charging transactions.
4. Develop a robust RFID-based payment system to enable seamless and secure transactions for EV charging, ensuring user convenience and operational efficiency.
5. Assess the environmental and economic benefits of solar-powered wireless charging systems, including reductions in carbon emissions, energy costs, and infrastructure complexity.
6. Explore the potential scalability and adaptability of the proposed charging system for widespread deployment across various workplace settings and geographic locations.
7. Provide insights into the role of innovative charging technologies in advancing sustainable transportation infrastructure and promoting the adoption of electric vehicles in the Netherlands and beyond..

MOTIVATION

The motivation behind this research stems from the pressing need to address the challenges associated with the growing demand for electric vehicles (EVs) and the corresponding infrastructure requirements. As EV adoption accelerates, particularly in environmentally conscious regions like the Netherlands, there is a critical need for sustainable and efficient charging solutions, especially in workplace environments where EVs are increasingly prevalent. Traditional charging infrastructure often relies on grid-connected systems, which may pose challenges in terms of scalability, energy efficiency, and environmental impact. By exploring the feasibility of solar-powered wireless charging systems, we aim to overcome these limitations and offer a compelling alternative that leverages renewable energy sources and innovative technology. Moreover, the integration of inductive coupling and Internet of Things (IoT) technologies promises to enhance user convenience, streamline payment processes, and optimize energy utilization. Ultimately, our research is driven by the vision of advancing sustainable transportation infrastructure, reducing carbon emissions, and fostering the widespread adoption of EVs, thereby contributing to a greener and more sustainable future.

SYSTEM ARCHITECTURE

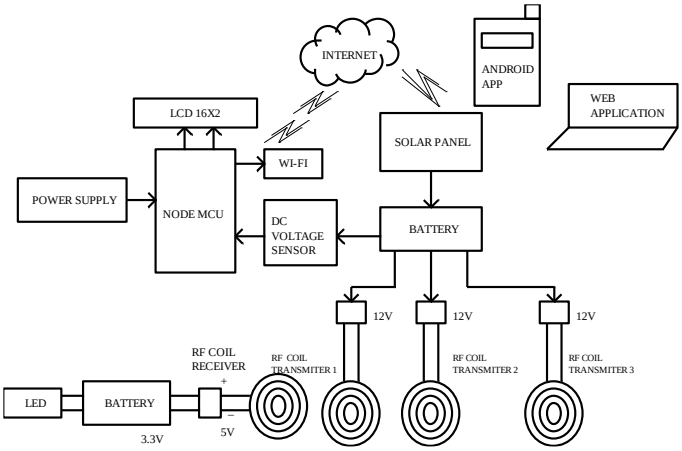

Fig -1: System Architecture Diagram

APPLICATION:

- Personal
- Transport
- Educational

CONCLUSION

In conclusion, this study has demonstrated the feasibility and potential benefits of implementing a solar-powered wireless charging system for electric vehicles (EVs) in workplace environments within the Netherlands. Through the utilization of inductive coupling technology and Internet of Things (IoT) integration, the proposed charging infrastructure offers a sustainable and efficient solution to meet the evolving needs of EV owners. By harnessing solar energy and eliminating the reliance on grid-connected systems, the charging system reduces carbon emissions, energy costs, and infrastructure complexity, while enhancing user convenience and safety. The development of a robust RFID-based payment system further enhances operational efficiency and ensures seamless transactions for EV charging. Overall, the convergence of renewable energy, wireless charging, and IoT technologies presents a promising avenue for advancing sustainable transportation infrastructure and promoting the widespread adoption of EVs. Moving forward, continued research and investment in innovative charging solutions will be essential to accelerate the transition towards a greener and more sustainable mobility ecosystem.

REFERENCES

[1]] Khalid MOHAMED; Henok K. WOLDE; Salma M. S. Optimal Space Utilisation for Solar Powered EV Charging Station, 2020 6th IEEE International Energy Conference (ENERGYCon)
[2] Seoeun Rho; Myeongseok Chae; Dongjun Won, Forecast-based Optimal Operation of EV Charging Station with PV Considering Charging Demand and Distributed System, 2024
[3 Berke Can Hasdemir; Dilber Acikgoz; Gokturk Poyrazoglu, A Stochastic Simulation for a Hybrid System of Solar Panels and EV Chargers, 2020.
[4] M. Debbache et al., "Design Parameters Effect on Annual Energy Production of Proposed Design of Parabolic Trough Solar Plant", 2018 6th International Renewable and Sustainable Energy Conference (IRSEC), pp. 1-6, 2018.
[5] J. R. Caron and B. Littmann, "Direct Monitoring of Energy Lost Due to Soiling on First Solar Modules in California", IEEE Journal of Photovoltaics, vol. 3, no. 1, pp. 336-340, Jan. 2013.
[6] K. Lee, K. Araki and M. Yamaguchi, "Analyzing the Cost Reduction Potential of III-V/Si Hybrid Concentrator Photovoltaic Systems", 2017 IEEE 44th Photovoltaic Specialist Conference (PVSC), pp. 1711-1713, 2017.
[7] W. Hudy, M. Piaskowska-Silarska, H. Noga, W. Kulinowski and K. Pytel, "Analysis of the possibility of reducing the amount of air pollution using photovoltaic systems", 2018 19th International Carpathian Control Conference (ICCC), pp. 565-569, 2018.