An IoT based Hybrid Electric Vehicle with Wireless Charging Technology

[1]Krishnaveni M, [2]Suruthi V, [3]Sowmiya C, [4]Sneha S, [5]Sathiyapriya P
[1]Assistant Professor, [2,3,4,5]UG Scholar
Department of Electronics and Communication Engineering
AVS Engineering College, Salem, Tamil Nadu, India.

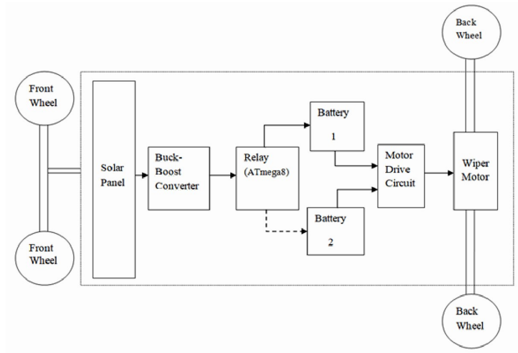
ABSTRACT–The rapid growth of electric vehicles (EVs) and the increasing demand for sustainable energy solutions have prompted the development of innovative charging technologies. This project focuses on the integration of Internet of Things (IoT) technology, solar energy harvesting, and wireless charging capabilities to create an advanced charging system for electric vehicles. The proposed system employs solar panels to harness clean and renewable energy, ensuring eco-friendly charging. Additionally, IoT connectivity enables real-time control of the charging process, enhancing overall efficiency and user experience. The cornerstone of this project lies in the implementation of a Coupled Magnetic Wireless Power Transfer (WPT) system, allowing for seamless and convenient charging without the need for physical connections between the charging station and the electric vehicle. This wireless charging technology not only simplifies the charging process but also reduces wear and tear on physical connectors, thereby prolonging the lifespan of both the charging infrastructure and the electric vehicle. Moreover, a mobile application serves as the user interface, providing drivers with the flexibility to choose between inductive coupled wireless technology or solar panel charging based on their preferences and environmental conditions. The application also offers insights into charging status, energy consumption, and cost-saving metrics, empowering users to make informed decisions regarding their charging habits and energy usage.Behind the scenes, a microcontroller orchestrates the overall charging process, ensuring seamless coordination between the various components of the system. By leveraging IoT connectivity, the microcontroller gathers real-time data on energy production, consumption, and grid demand, optimizing the charging process for both individual users and the broader energy ecosystem. Through the integration of these cutting-edge technologies, this project aims to address key challenges related to charging infrastructure scalability, energy sustainability, and user experience in the electric vehicle ecosystem. By showcasing a viable and scalable solution, it seeks to accelerate the widespread adoption of electric vehicles while advancing sustainable energy practices in the transportation sector.

INTRODUCTION

The rise of electric vehicles (EVs) and the growing demand for eco-friendly energy solutions have sparked a surge in innovation within charging technologies. This initiative stands at the forefront of this wave, aiming to merge Internet of Things (IoT) technology, solar energy harvesting, and wireless charging capabilities to pioneer an advanced charging infrastructure for EVs. Solar panels are utilized to tap into renewable energy sources, ensuring environmentally conscious charging practices. Additionally, IoT connectivity enables dynamic control of the charging process in real-time, boosting overall operational efficiency and user satisfaction. A key element of this project is the implementation of Coupled Magnetic Wireless Power Transfer (WPT) system, which revolutionizes the charging process by eliminating the need for physical connections between the charging station and the EV, thus enhancing longevity and simplifying the process. A user-friendly mobile application acts as the interface, allowing drivers to select from various charging options based on their preferences and environmental factors. By providing insights into charging status, energy consumption, and cost-saving metrics, the application empowers users to make informed decisions about their charging habits and energy usage. A sophisticated microcontroller manages the intricacies of the charging process, ensuring seamless coordination between components while optimizing energy utilization in real-time through IoT connectivity. Through the integration of these cutting-edge technologies, this initiative aims to address critical challenges in charging infrastructure scalability, energy sustainability, and user experience within the EV ecosystem, driving widespread adoption and advancing sustainable energy practices in the transportation sector.

SYSTEM DESCRIPTION OF EXISTING SYSTEM

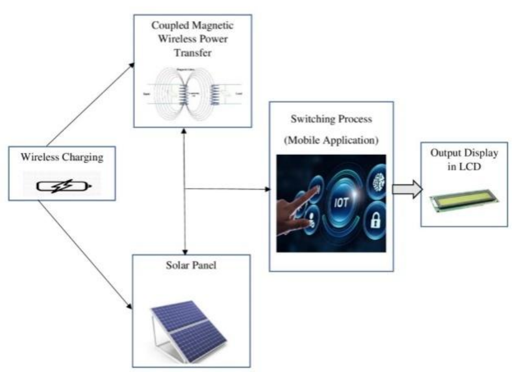
The existing electric vehicle configuration incorporates a solar panel positioned on the vehicle's roof to replenish its battery reserves. This setup employs buck and boost converters to effectively regulate the solar energy supply. However, one disadvantage of this system is its susceptibility to variations in sunlight intensity, which can affect the efficiency of the solar panel's charging capabilities. An ATMEGA 328 microcontroller manages the allocation of power between Battery 1 and Battery 2, ensuring a consistent and reliable energy flow to power the essential wiper motor, critical for the vehicle's operation. Nonetheless, a potential drawback is the complexity of the microcontroller system, which may require regular maintenance and updates to ensure optimal performance.



In order to optimize overall vehicle efficiency, a DC generator has been strategically installed at the midpoint of the rear wheel. This generator efficiently transforms rotational energy derived from wheel movement into electrical power. However, a limitation of this setup is the additional mechanical load imposed on the wheel, potentially affecting vehicle maneuverability and increasing wear and tear. The generated electricity from the DC generator is then directed to a buck-boost converter to ensure proper voltage regulation. Subsequently, the regulated output is directed to a voltage regulator, guaranteeing a stable power supply to the motor. Despite these voltage regulation measures, inefficiencies in the conversion process may lead to energy losses and reduced overall system efficiency. This seamlessly integrated system represents a significant advancement in energy utilization, effectively harnessing solar power and wheel rotation to maintain battery charge and support motor operation, respectively. However, it's important to acknowledge and address the potential disadvantages and challenges associated with each component to ensure the continued development of more efficient and environmentally-friendly transportation solutions.

SYSTEM DESCRIPTION FOR PROPOSED SYSTEM

Our proposed system comprises several key components, each playing a vital role in its functionality. Solar panels are utilized to harness clean and renewable energy for eco-friendly charging, reducing carbon footprint and dependency on conventional energy sources. The cornerstone of our system lies in the implementation of a Coupled Magnetic Wireless Power Transfer (WPT) system, enabling seamless and convenient charging without the need for physical connections between the charging station and the EV. This wireless charging technology simplifies the charging process, reduces wear and tear on physical connectors, and prolongs the lifespan of both the charging infrastructure and the EV.



IoT connectivity forms the backbone of our system, facilitating real-time control and monitoring of the charging process. By gathering real-time data on energy production, consumption, and grid demand, our IoT-enabled system optimizes the charging process for individual users and the broader energy ecosystem. Behind the scenes, a microcontroller orchestrates the overall charging process, ensuring seamless coordination between the various components of the system. An LCD display provides users with real-time feedback on charging status and energy consumption, enhancing user engagement and experience. A mobile application serves as the user interface, offering drivers the flexibility to choose between inductive coupled wireless technology or solar panel charging based on their preferences and environmental conditions. Additionally, the application provides insights into charging status, energy consumption, and cost-saving metrics, empowering users to make informed decisions regarding their charging habits and energy usage.

CONCLUSION

In conclusion, the integration of IoT-enabled wireless charging, solar energy harvesting, and real-time monitoring represents a significant leap forward in addressing the critical challenges facing EV charging infrastructure. By harnessing these cutting-edge technologies, our proposed system not only enhances the efficiency and convenience of EV charging but also contributes to the broader transition towards sustainable transportation solutions. Through seamless integration and scalability, our system is poised to accelerate the adoption of EVs, facilitating their widespread acceptance among consumers and businesses alike. Moreover, by promoting the use of renewable energy sources and reducing reliance on fossil fuels, our solution aligns with global efforts to combat climate change and promote environmental sustainability. As we continue to innovate and refine our approach, we remain committed to driving positive change in the transportation sector and advancing the adoption of EVs as a key pillar of sustainable mobility.

REFERENCES

[1] FahmidaNaznin TVS Motor Company Ltd year 2013, ”State of Charge (SOC) Governed Fast Charging Method for Lithium Based Batteries”, COMSOL Conference in Bangalore.

[2] Florian Feckl December 2014, ”Efficient Charging with TPS62740”, TEXAS INSTRUMENTS Application Report SLVA678.

[3] Chenglin Liao, Bing Yang: PhasesMARCH 2018, ”Controlled Coordinated Charging Method for Electric Vehicles , CES transactions on electrical machines and systems, VOL. 2, NO. 1.

[4] H. S. Upare, P. S. Pandure,” Design and Experimental Study of Solar Hybrid vehicle”, A review IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP. 44-48.

[5] T. S. Biya and M. R. Sindhu, 2019, "Design and Power Management of Solar Powered Electric Vehicle Charging Station with Energy Storage System," 2019 3rd Int. conf. on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, pp. 815-820.

[6] S. Patel and K. Rao, "Social acceptance of solar energy technology in India", *2016 International Conference on Energy-Efficient Technologies for Sustainability (ICEETS)*, 2016.

[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