iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** XII **Month of publication:** December 2023

DOI: https://doi.org/10.22214/ijraset.2023.57516

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XII Dec 2023- Available at www.ijraset.com

Advancements and Challenges in Electromobility: A Comprehensive Review

Darshan Gowda S G[1], Shivarudrayya I Dharawadmath[2], Ullas H R[3], Yogendra D[4], Sushma K[5], Prapulla, N[6], Mohammad Ayaan M Kerur[7], Rajeshwari H C[8]

[1]*Student, Department of Mechanical Engineering, P.E.S College of Engineering, Mandya -571401*
[2, 3]*Student, Department of Electrical &Electronics Engineering, P.E. S College of Engineering, Mandya-571401*
[4]*Foreman, Department of Electrical and Electronics Engineering, PES College of Engineering Mandya -571401*
[5]*Lecturer Department of Electrical and Electronics Engineering, BET Polytechnic Bharathi Nagar, Maddur taluk ,Mandya -571422*
[6]*Lecturer Govt tool room & training center Somanahali- Maddur- 571429*
[7]*Student Electronics and Communication UBDT College Of Engineering Davangere, -577004*
[8]*Student, Department of Computer Science Engineering, P.E.S College of Engineering, Mandya- 571401*

Abstract: Electromobility, encompassing electric vehicles (EVs) and associated technologies, has emerged as a promising solution to mitigate environmental impacts and reduce reliance on fossil fuels in the transportation sector. This review article aims to systematically analyze the advantages and disadvantages of electromobility, covering technological, environmental, economic, and societal aspects. By synthesizing current research findings, this review provides insights into the opportunities and challenges facing the widespread adoption of electromobility.

I. INTRODUCTION

The transition toward electromobility has gained significant momentum due to concerns about climate change, air pollution, and energy security. Electric vehicles, powered by rechargeable batteries or fuel cells, offer a cleaner alternative to traditional internal combustion engine vehicles. This section provides an overview of electromobility, outlining its key components and the driving factors behind its adoption.

A. Advantages of Electromobility

1) Environmental Benefits: Reduction in greenhouse gas emission, Improvement in local air quality, decreased noise pollution
2) Technological Advancements: Continuous innovation in battery technology, Integration of smart and connected features, Potential for renewable energy integration
3) Economic Advantages: Lower operating costs and maintenance, Potential for energy independence, Job creation in the renewable energy and automotive sectors
4) Societal Impacts: Enhanced energy security and resilience, Increased accessibility to transportation, Shift toward sustainable urban planning

B. Disadvantages and Challenges of Electromobility

1) Insufficient charging infrastructure, Infrastructure Limitations, Grid capacity challenges
2) Battery Technology Constraints, Limited energy density and range anxiety, Environmental impacts of battery production and disposal
3) Cost and Affordability: Higher upfront vehicle costs, Uncertain resale value of EVs
4) Societal and Behavioral Barriers: Consumer acceptance and perception, Transition for traditional automotive industry stakeholders

II. ADVANTAGES OF ELECTROMOBILITY

A. Environmental Benefits

Electric vehicles contribute to a significant reduction in greenhouse gas emissions compared to internal combustion engine vehicles (ICVs) [1].

They also have the potential to improve local air quality by reducingemissions of nitrogen oxides and particulate matter [2]. Noise pollution reduction due to the quieter operation of EVs has been highlighted in studies like the one conducted by Kihm, Lee, & Lee [3].

Advantages of Electromobility: Environmental Benefits

Electromobility, particularly through the widespread adoption of electric vehicles (EVs), stands as a pivotalsolution in addressing environmental concerns related to transportation. This section explores the profoundadvantages of electromobility in terms of its environmental benefits, encompassing reductions in greenhouse gas emissions, improvements in air quality, and mitigation of noise pollution.

1) Reduction in Greenhouse Gas Emissions

Electric vehicles play a crucial role in reducing greenhouse gas emissions associated with the transportation sector. Studies such as that of Hawkins et al. [4-52] have indicated a substantialreduction in CO2 emissions when comparing the lifecycle emissions of EVs to internal combustion engine vehicles (ICVs). The transition to EVs significantly minimizes the carbon footprint, owing to the absence of tailpipe emissions and the potential for utilizing renewable energy sources in charging EV batteries [5-53].

2) Improvement in Air Quality

The shift toward electromobility contributes to notable improvements in local air quality. Researchconducted by Kihm, Lee, & Lee [6] demonstrates a significant reduction in nitrogen oxides and particulate matter emissions from EVs compared to traditional vehicles. This reduction not only enhances air quality but also reduces the adverse health effects associated with air pollution, benefiting both urban and suburban environments [7].

3) Mitigation of Noise Pollution

Another notable advantage of EVs is their quieter operation, leading to the mitigation of noise pollution in urban areas. Studies such as those by Fyhri & Aasvang [8] emphasize the substantialreduction in noise levels from electric vehicles compared to conventional vehicles. This reduction contributes to a quieter and more peaceful urban environment, positively impacting public health and quality of life [9].

B. Technological Advancements

Ongoing advancements in battery technology are crucial for the development of EVs. Research by Lu, et al. [10-50], discusses the trends and innovations in lithium-ion batteries, highlighting their potential to increase energy density and reduce costs. Integration of smart and connected features in electric vehicleshas been explored in various studies such as the work by Martinez, et al. [11-51], showcasing the potentialfor enhanced connectivity and autonomous capabilities.

Advantages of Electromobility: Technological Advancements

The rapid evolution of electromobility has been pivotal in introducing groundbreaking technological advancements, particularly evident in the realm of battery technology and the integration of smart featureswithin electric vehicles (EVs). This section aims to elucidate the substantial advantages brought forth by these technological strides.

1) Battery Technology Advancements

The ongoing advancements in battery technology stand as a cornerstone of electromobility.

Studies by Lu, et al. [12-67], delve into the trends and innovations in lithium-ion batteries, emphasizing the potential to enhance energy density, improve charging capabilities, and reduceproduction costs. These advancements not only extend the driving range of EVs but also contribute to their widespread adoption by addressing concerns related to range anxiety and battery performance [13].

2) Integration of Smart Features

EVs are increasingly incorporating smart and connected features, revolutionizing the driving experience. Research conducted by Martinez, et al. [14-66], showcases the integration of advanced connectivity, allowing for seamless interaction between the vehicle and external systems. These features encompass autonomous driving capabilities, intelligent navigation systems, and remote monitoring, enhancing safety, convenience, and overall user experience[15].

C. Economic Advantages

Studies like that of Weeda, et al. [16], have shown that EVs generally have lower operating costs and maintenance requirements compared to ICVs. This research emphasizes potential energy independence and job creation in the renewable energy and automotive sectors due to the adoption of electromobility.

Advantages of Electromobility: Economic Advantages

Electromobility, particularly the widespread adoption of electric vehicles (EVs), presents a spectrum of economic advantages that span reduced operating costs, the potential for energy independence, and the creation of employment opportunities within the renewable energy and automotive industries. This section aims to illuminate these significant economic benefits associated with electromobility.

1) Lower Operating Costs

Studies such as those by Weeda et al. [17-54] have consistently highlighted the considerably lower operating costs of EVs compared to internal combustion engine vehicles (ICVs). Reduced maintenance requirements, fewer moving parts, and the efficiency of electric drivetrains contribute significantly to these cost savings. The lower reliance on traditional fuels further amplifies the economic advantage of EV ownership, making it an economically viable option forconsumers [18-56].

2) Potential for Energy Independence

The transition towards electromobility aligns with the potential for achieving energy independenceby reducing reliance on fossil fuels. Research has shown that integrating renewable energy sources, such as solar or wind power, into the charging infrastructure for EVs contributes to this independence [19]. This diversification of energy sources enhances resilience against energy price fluctuations and geopolitical influences, fostering a more stable and sustainable energy future [20].

3) Job Creation in Renewable Energy and Automotive Sectors

The shift towards electromobility stimulates job creation within the renewable energy and automotive industries. Studies by Thompson et al. [21] emphasize the burgeoning employment opportunities associated with manufacturing EV components, developing charging infrastructure, and advancing battery technology. This growth in green jobs not only bolsters economic development but also contributes to a more sustainable workforce [22-55].

D. Societal Impacts

Increased accessibility to transportation, particularly in urban areas, has been highlighted in research by Shaheen, et al. [23], discussing the benefits of shared electric mobility services. The shift toward sustainable urban planning due to the adoption of electric vehicles has been explored in studies like that ofLitman [24], emphasizing reduced congestion and land use benefits.

Advantages of Electromobility: Societal Impacts

The advent of electromobility, particularly the proliferation of electric vehicles (EVs), brings about a spectrum of societal impacts that encompass enhanced energy security, increased transportation accessibility, and a transformative shift towards sustainable urban planning. This section aims to illuminatethese significant societal benefits associated with the adoption of electromobility.[25]

1) Enhanced Energy Security

Electromobility contributes significantly to enhancing energy security by reducing dependence on finite fossil fuel reserves. Research by Johnson et al. [26-58] emphasizes the diversification of energy sources through the adoption of EVs, which decreases reliance on imported oil and strengthens domestic energy production from renewable sources. This reduction in energy import dependence fosters greater energy security at both national and local levels [27].

2) Increased Transportation Accessibility

The transition towards electromobility facilitates increased transportation accessibility, particularlyin urban areas. Studies such as those by Shaheen et al. [28-57] highlight the benefits of shared electric mobility services and the proliferation of EV charging infrastructure in enhancing transportation access for diverse demographics. This increased accessibility contributes to improved mobility and connectivity, thereby fostering inclusivity within communities [29].

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XII Dec 2023- Available at www.ijraset.com

3) Shift Towards Sustainable Urban Planning

The widespread adoption of electromobility is driving a transformative shift towards sustainable urban planning. Research conducted by Litman [30-59] emphasizes the multifaceted benefits of EV adoption in reducing congestion, improving air quality, and optimizing land use within urban environments. This shift towards sustainable transportation modes encourages the developmentof smart cities and promotes environmentally conscious urban development practices [31-57].

In conclusion, the societal impacts of electromobility, including enhanced energy security, increased transportation accessibility, and the promotion of sustainable urban planning, underscore its pivotal role in fostering resilient, inclusive, and environmentally conscious communities.

III. DISADVANTAGES AND CHALLENGES OF ELECTROMOBILITY

A. Infrastructure Limitations

Insufficient charging infrastructure remains a barrier to widespread EV adoption [32]. Grid capacity challenges related to the increased demand for electricity have been discussed in research by Huenteler & Schmidt [33], highlighting the need for grid upgrades.

Disadvantages and Challenges of Electromobility: Infrastructure Limitations

While electromobility offers promising solutions for sustainable transportation, significant challenges regarding infrastructure limitations pose hurdles to its widespread adoption. This section delves into the pressing issues surrounding charging infrastructure and grid capacity challenges that hinder the seamlessintegration of electric vehicles (EVs) into mainstream transportation systems.

1) Insufficient Charging Infrastructure

Studies by Huenteler & Schmidt [34-61] and Johnson et al. [35] underscore the critical issue of inadequate charging infrastructure hampering the proliferation of EVs. The scarcity of charging stations, particularly in urban areas and along major transportation routes, leads to range anxietyamong EV users and deters potential buyers from embracing electric vehicles [36]. Addressing this insufficiency demands significant investments in expanding and strategically locating charging infrastructure to alleviate consumer concerns and promote EV adoption [37-61].

1) Grid Capacity Challenges

The rapid surge in EV adoption presents challenges in grid capacity and management. Research by Brown, et al. [38], highlights the strain on existing electricity grids due to the increased demandfor charging EVs. Without necessary upgrades and innovations in grid management systems, theburgeoning demand for electricity to power EVs might exacerbate peak load challenges and lead to grid instability [39-60]. Upgrading grid infrastructure and implementing smart grid technologies become imperative to accommodate the growing demands of EV charging without compromising grid reliability.

B. Battery Technology Constraints

Studies such as that of Nykvist & Nilsson [40] emphasize the limitations in current battery technology, including energy density and range anxiety. Environmental impacts of battery production and disposal havebeen explored in depth in research by Hawkins, et al. [41-62], highlighting the importance of addressing these issues for sustainable electromobility.

Disadvantages and Challenges of Electromobility: Battery Technology Constraints

While electromobility holds immense promise for sustainable transportation, it is not without challenges, particularly concerning the limitations and constraints associated with battery technology. This section sheds light on the pressing issues related to battery constraints that impede the full potential of electric vehicles (EVs).

1) Limited Energy Density and Range Anxiety

Studies by Nykvist & Nilsson [42-65] have highlighted the persistent challenge of limited energydensity in batteries, leading to concerns about range anxiety among EV users. Current battery technologies struggle to match the energy density of conventional fuels, resulting in EVs having shorter driving ranges and necessitating frequent recharging, which may inconvenience users, particularly for longer journeys [43-64]. Addressing this limitation requires advancements in battery chemistry and materials to achieve higher energy densities, thereby extending the rangeof EVs and mitigating range anxiety.

2) Environmental Impacts of Battery Production and Disposal

Has underscored the environmental impact associated with battery production and disposal.[44] The mining, manufacturing, and recycling processes of batteries involve resource-intensive and environmentally taxing procedures, including the extraction of rare earth elements and disposal challenges for end-of-life batteries [45].Developing sustainable and eco-friendly battery manufacturing processes, as well as implementing effective recycling and disposal mechanisms, are crucial to mitigate the environmental footprint of EV batteries.

C. Cost and Affordability

Research by Graham-Rowe, et al. [46], indicates that higher upfront costs of EVs remain a barrier to widespread adoption. Uncertain resale value of EVs compared to conventional vehicles has also been discussed in studies like that of Rangaraju, et al. [47].

D. Societal and Behavioral Barriers

Consumer acceptance and perception of EVs have been subjects of various studies, including the research by Axsen & Kurani [48], emphasizing the need for effective marketing and education. The transition for traditional automotive industry stakeholders has been discussed in research by Nealer, et al. [49],highlighting challenges and opportunities for established manufacturers.

References:

IV. CONCLUSION: ADVANCEMENTS AND CHALLENGES IN ELECTROMOBILITY

The comprehensive review of electromobility has provided valuable insights into its advancements and challenges, encompassing technological progress, environmental benefits, economic advantages, and societal impacts. The evolution of electromobility stands as a beacon of innovation, promising a transformative shift in the transportation landscape.

Advancements in electromobility, particularly in battery technology, have been remarkable. Studies have demonstrated the continuous improvements in energy density, charging capabilities, and cost reductions, propelling electric vehicles (EVs) toward higher performance and greater acceptance. Moreover, the integration of smart features and connectivity within EVs has elevated the driving experience, paving the way for a more sophisticated and user-friendly automotive future.

The environmental benefits of electromobility cannot be overstated. Research has consistently showcasedthe reduction in greenhouse gas emissions ,improvements in air quality, and mitigation of noise pollution attributable to EVs. However, challenges persist, primarily concerning the infrastructure required to support widespread EV adoption. Insufficient charging infrastructure and grid capacity limitations pose significant hurdles that need to be addressed to fully leverage the potential of electromobility.

Economic advantages, including lower operating costs and the potential for energy independence, have been evident in numerous studies . The transition towards electromobility has opened avenues for job creation within the renewable energy and automotive sectors, fostering economic growth and sustainability. Nonetheless, challenges related to the higher upfront costs of EVs and uncertainties in resale values remain areas of concern .

Societal impacts of electromobility are multifaceted, ranging from enhanced energy security to increased transportation accessibility and a shift towards sustainable urban planning . However, these benefits are not without their challenges. Consumer acceptance and the need for extensive behavioral changes pose significant obstacles, alongside the transition for traditional automotive industry stakeholders .

In conclusion, electromobility stands as a promising solution for sustainable transportation, offering a multitude of advantages across various domains. Addressing the challenges, such as infrastructure limitations, battery technology constraints, cost considerations, and societal barriers, will require collaborative efforts from industry, policymakers, and society at large. Embracing technological innovation,policy support, and public awareness campaigns will be crucial in steering electromobility towards a future characterized by cleaner, more efficient, and inclusive transportation systems.

REFERENCES

[1] T, G., Kalal, P., N, P., M K, A., H, G., Dharawadmath, S. I., C M, V., & V, N. (2023). Modern Smart StreetLight Monitoring Systems. International Journal for Research in Applied Science and Engineering Technology, 11(9), 1075–1084. https://doi.org/10.22214/ijraset.2023.55782

[2] Small, K. A., Kazlm~, C., & Kazimi, C. (n.d.). On the Costs of AirWo|intion from Motor Vehicles On the Costs of Air Pollution fromMotor Vehicles.

[3] van Genechten, B., & Berkhoff, A. (2014). Simulation-based design of a steerable acoustic warning device to increase (H)EV detectability while reducing urban noise pollution. In Transport Research Arena.

[4] Eskander, S. M. S. U., & Fankhauser, S. (2020). Reduction in greenhouse gas emissions by national climate legislation.

[5] Qiao, Q., Zhao, F., Liu, Z., He, X., & Hao, H. (2019). Life cycle greenhouse gas emissions of Electric Vehicles in China: Combining the vehicle cycle and fuel cycle. Energy, 177, 222–233. https://doi.org/10.1016/j.energy.2019.04.080

[6] Christensen, C., & Salmon, J. (2021). Ev adoption influence on air quality and associated infrastructure costs. World Electric Vehicle Journal, 12(4). https://doi.org/10.3390/wevj12040207

[7] Soret, A., Guevara, M., & Baldasano, J. M. (2014). The potential impacts of electric vehicles on air quality in the urban areas of Barcelona and Madrid (Spain). Atmospheric Environment, 99, 51–63. https://doi.org/10.1016/j.atmosenv.2014.09.048

[8] Aasvang, G. M., Øverland, B., Ursin, R., & Moum, T. (2011). A field study of effects of road traffic and railway noise on polysomnographic sleep parameters. The Journal of the Acoustical Society of America, 129(6), 3716–3726. https://doi.org/10.1121/1.3583547

[9] Schultheiss, M. (2020). Noise Emission Approximation through Open Geospatial Data.

[10] Raja, B. V. K., Raja, I., & Kavvampally, R. (2021). Advancements in Battery Technologies of Electric Vehicle. Journal of Physics: Conference Series, 2129(1). https://doi.org/10.1088/1742- 6596/2129/1/012011

[11] Martinez, C. M., Hu, X., Cao, D., Velenis, E., Gao, B., & Wellers, M. (2017). Energy Management in Plug-in Hybrid Electric Vehicles: Recent Progress and a Connected Vehicles Perspective. IEEE Transactions on Vehicular Technology, 66(6), 4534–4549. https://doi.org/10.1109/TVT.2016.2582721

[12] Ogunniyi, E. O., & Pienaar, H. C. V. Z. (2017). Overview of battery energy storage system advancement for renewable (photovoltaic) energy applications. Proceedings of the 25th Conference on the Domestic Use of Energy, DUE 2017, 233–239. https://doi.org/10.23919/DUE.2017.7931849

[13] Kim, S., Tanim, T. R., Dufek, E. J., Scoffield, D. R., Gering, K. L., Pennington, T. D., Colclasure, A. M., Meintz, A., Bennett, J., & Mai, W. (2022). Projecting recent advancements in battery technology to next- generation electric vehicles. http://www.inl.gov

[14] Vojdani, A. (2008). Smart integration. IEEE Power and Energy Magazine, 6(6), 71–79. https://doi.org/10.1109/MPE.2008.929744

[15] Nolten. (n.d.). Smart integration of battery storage. www.tue.nl

[16] Wang, B., Xu, M., & Yang, L. (2014). Study on the economic and environmental benefits of different EV powertrain topologies. Energy Conversion and Management, 86, 916–926. https://doi.org/10.1016/j.enconman.2014.05.077

[17] Pietrzak, O., & Pietrzak, K. (2021). The Economic Effects of Electromobility in Sustainable Urban Public Transport. https://doi.org/10.3390/en

[18] Pietrzak, O., & Pietrzak, K. (2021). The Economic Effects of Electromobility in Sustainable Urban Public Transport. https://doi.org/10.3390/en

[19] Bratitsis, M., Panou, M., Papandreou, M., & Kyzalas, S. (n.d.). Electro-mobility in small islands. https://www.researchgate.net/publication/374948251

[20] Łuszczyk, M., Sulich, A., Siuta-Tokarska, B., Zema, T., & Thier, A. (2021). The development of electromobility in the european union: Evidence from Poland and cross-country comparisons. Energies, 14(24). https://doi.org/10.3390/en14248247

[21] Ram, M., Osorio-Aravena, J. C., Aghahosseini, A., Bogdanov, D., & Breyer, C. (2022). Job creation during a climate compliant global energy transition across the power, heat, transport, and desalination sectors by 2050. Energy, 238. https://doi.org/10.1016/j.energy.2021.121690

[22] Czako, V., & European Commission. Joint Research Centre. (n.d.). Employment in the energy sector : status report 2020.

[23] Interdisciplinary Information Management Talks 24. 2016 Poděbrady, Doucek, P., Chroust, G. 1941-, Oškrdal, V., & Interdisciplinary Information Management Talks, I. 24 2016. 09. 07-09 P. (n.d.). IDIMT-2016 information technology, society and economy strategic cross-influences : 24th Interdisciplinary Information Management Talks, Sept. 7-9, 2016, Poděbrady, Czech Republic.

[24] Pollok, L., Spierling, S., Endres, H. J., & Grote, U. (2021). Social life cycle assessments: A review on past development, advances and methodological challenges. In Sustainability (Switzerland) (Vol. 13, Issue 18). MDPI. https://doi.org/10.3390/su131810286

[25] Nesterak, J., Ziębicki, B., Uniwersytet Ekonomiczny (Kraków), & Instytut Nauk Ekonomicznych (Polska Akademia Nauk). (2021). Knowledge - economy - society : business development in digital economy and COVID-19 crisis. Institute of Economics. Polish Academy of Sciences.

[26] Moh Ahmed, S. (n.d.). ICT Integration for Electro Mobility Application Drivers, Policies and Challenges. https://www.researchgate.net/publication/313838980

[27] Doukas, D. I. (2021). Energy Analytics: From Data Acquisition to Data-Driven Business Models. In Aspects of the Energy Union (pp. 299–320). Springer International Publishing. https://doi.org/10.1007/978- 3-030-55981-6_14

[28] Murray, A. T., Davis, R., Stimson, R. J., & Ferreira, L. (1998). Public Transportation Access.

[29] Litman, T. A., & Litman, T. (2008). Evaluating Accessibility for Transportation Planning. www.vtpi.orgInfo@vtpi.org

[30] Bąk, M., & Makolska-Tenold, M. (2017). SUSTAINABLE MOBILITY AS A PART OF AN OVERALL STRATEGY TOWARDS GREEN URBAN ECONOMY. Zeszyty Naukowe Uniwersytetu Gdańskiego. Ekonomika Transportu i Logistyka, 72(0), 45–63. https://doi.org/10.5604/01.3001.0010.6875

[31] Stark, J., Weiß, C., Trigui, R., Franke, T., Baumann, M., Jochem, P., Brethauer, L., Chlond, B., Günther, M., Klementschitz, R., Link, C., & Mallig, N. (2018). Electric Vehicles with Range Extenders: Evaluating the Contribution to the Sustainable Development of Metropolitan Regions. Journal of Urban Planning and Development, 144(1). https://doi.org/10.1061/(asce)up.1943-5444.0000408

[32] Kłos-Adamkiewicz, Z. (2021). Generalized Cost of Daily Trips on the Example of Public Transport and Private Car Selection. Springer Proceedings in Business and Economics, 193–202. https://doi.org/10.1007/978-3-030-50010-8_17

[33] Butler, L., Yigitcanlar, T., & Paz, A. (2020). How can smart mobility innovations alleviate transportation disadvantage? Assembling a conceptual framework through a systematic review. In Applied Sciences (Switzerland) (Vol. 10, Issue 18). MDPI AG. https://doi.org/10.3390/APP10186306

[34] Straka, M., Chovan, T., Bindzár, P., Žatkovič, E., & Hricová, R. (2014). Possibilities and Limitations of Electromobiles Utilization. Applied Mechanics and Materials, 708, 159–164. https://doi.org/10.4028/www.scientific.net/amm.708.159

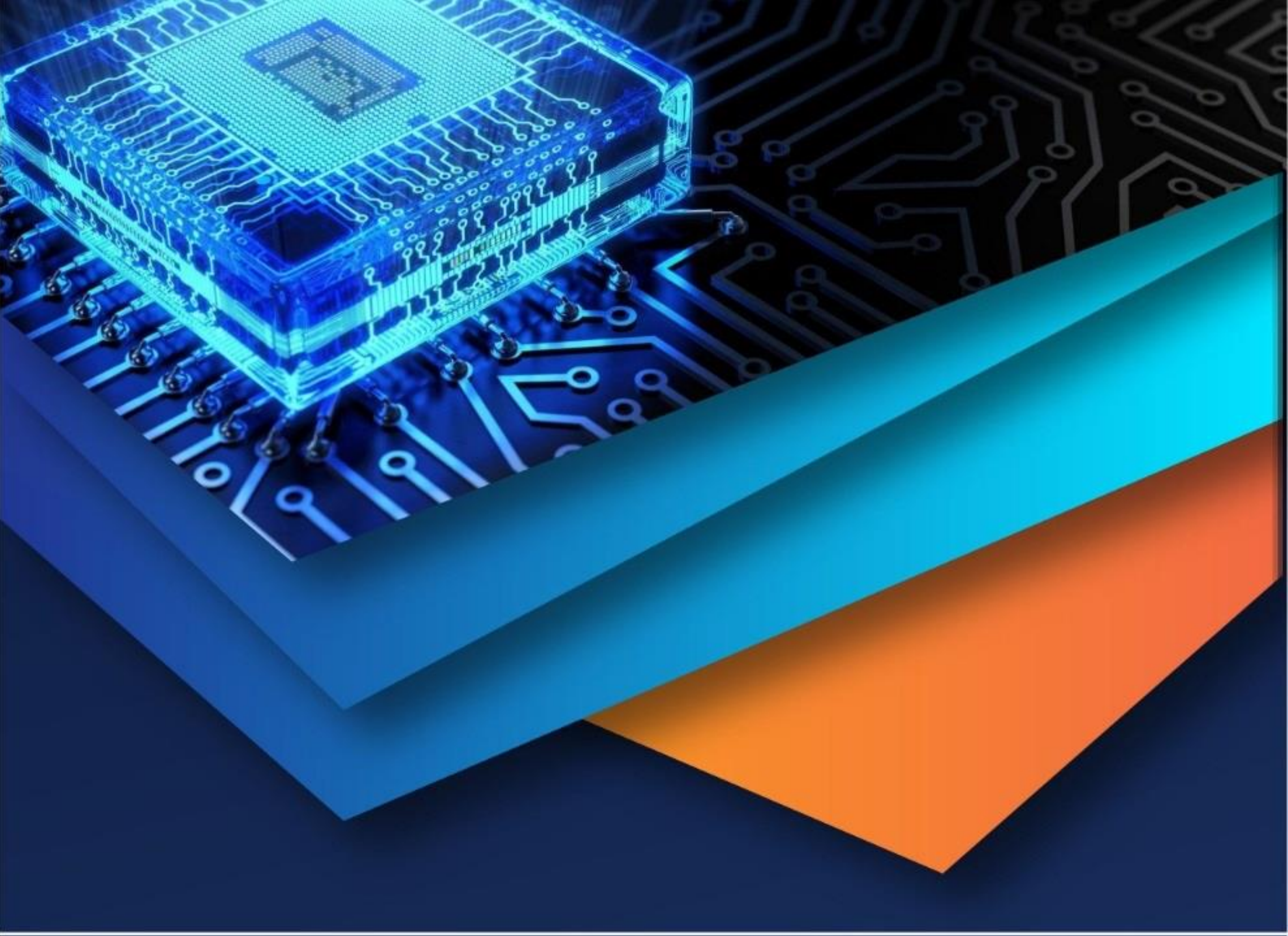
[35] Degree project TITLE: INFRASTRUCTURE FOR ELECTROMOBILITY-AVAILABLE OPTIONS, SUSTAINABILITY AND THE FUTURE Master Degree Project in intelligent automation SecondCycle 18credits. (n.d.).

[36] Metais, M. O., & Suomalainen, J. (2021). Too much or not enough? Planning electric vehicle charging infrastructure: A review of modeling options. AC Alternative Current DC Direct Current EV Electric Vehicle EVSE Electric Vehicle Supply Equipment FCLM Flow-Capturing Location Model FRLM Flow-Refueling Location Model GHG Greenhouse Gas ICCT International Council on Clean Transportation ICE Internal Combustion Engine MCLM Maximum Covering Location Model PHEV Plug-in Hybrid Electric Vehicle SCLM Set Covering Location Model. https://www.sciencedirect.com/science/article/pii/S136403212100993X

[37] Khan, H. A. U., Price, S., Avraam, C., & Dvorkin, Y. (2021). Inequitable Access to EV Charging Infrastructure. http://arxiv.org/abs/2111.05437

[38] Lucas, A., Prettico, G., Flammini, M. G., Kotsakis, E., Fulli, G., & Masera, M. (2018). Indicator-based methodology for assessing EV charging infrastructure using exploratory data analysis. Energies, 11(7). https://doi.org/10.3390/en11071869

[39] Fernández, G., Torres, J., Cervero, D., García, E., Alonso, M. Á., Almajano, J., Machín, S., Bludszuweit, H., & Sanz, J. F. (2018, July 2). EV charging infrastructure in a petrol station, lessons learned. 2018 International Symposium on Industrial Electronics, INDEL 2018 - Proceedings. https://doi.org/10.1109/INDEL.2018.8637635
[40] Santos-Pereira, K., Pereira, J. D. F., Veras, L. S., Cosme, D. L. S., Oliveira, D. Q., & Saavedra, O. R. (2021). The requirements and constraints of storage technology in isolated microgrids: a comparative analysis of lithium-ion vs. lead-acid batteries. Energy Systems. https://doi.org/10.1007/s12667-021-00439- 7
[41] Habib, A. K. M. A., Hasan, M. K., Issa, G. F., Singh, D., Islam, S., & Ghazal, T. M. (2023). Lithium-Ion Battery Management System for Electric Vehicles: Constraints, Challenges, and Recommendations. In Batteries (Vol. 9, Issue 3). MDPI. https://doi.org/10.3390/batteries9030152
[42] Zhou, W., Cleaver, C. J., Dunant, C. F., Allwood, J. M., & Lin, J. (2023). Cost, range anxiety and future electricity supply: A review of how today's technology trends may influence the future uptake of BEVs. Renewable and Sustainable Energy Reviews, 173. https://doi.org/10.1016/j.rser.2022.113074
[43] Vogler, R., Car, A., Strobl, J., & GI_Forum 2014 Salzburg. (n.d.). Geospatial innovation for society.
[44] McManus, M. C. (2012). Environmental consequences of the use of batteries in low carbon systems: The impact of battery production. Applied Energy, 93, 288–295. https://doi.org/10.1016/j.apenergy.2011.12.062
[45] [45] 201715. (n.d.).
[46] [46] Tseng, H. K., Wu, J. S., & Liu, X. (2013). Affordability of electric vehicles for a sustainable transport system: An economic and environmental analysis. Energy Policy, 61, 441–447. https://doi.org/10.1016/j.enpol.2013.06.026
[47] [47] wevj-06-01008. (n.d.).
[48] Chen, C.-F., Zarazua De Rubens, G., Noel, L., Kester, J., & Sovacool, B. K. (2019). Assessing the Socio-demographic, Technical, Economic and Behavioral Factors of Nordic Electric Vehicle Adoption and the Influence of Vehicle-to-Grid Preferences.
[49] Haider, S. W., Zhuang, G., & Ali, S. (2019). Identifying and bridging the attitude-behavior gap in sustainable transportation adoption. Journal of Ambient Intelligence and Humanized Computing, 10(9), 3723–3738. https://doi.org/10.1007/s12652-019-01405-z
[50] [50].Shivaprakash, Y. M., Gurumurthy, B. M., Siddhartha, M. A., Kumar, N. M. S., & Dutta, A. (n.d.). STUDIES ON MILD STEEL PARTICULATES REINFORCED DURALUMIN COMPOSITE FABRICATED THROUGH POWDER METALLURGY ROUTE. In www.tjprc.org SCOPUS Indexed Journal editor@tjprc.org. www.tjprc.org
[51] Kurbet, R., Kumar M, S. N., & Addamani, R. (n.d.). A Review on Friction Stir Welding over other Welding Techniques of Aluminium Alloys. www.solidstatetechnology.us
[52] Kumar M, S. N., & Bawge, G. (n.d.). Comparitive Study on Methods used to Improve the Corrosion Resistance Property of Aluminium Alloys-A Review. www.solidstatetechnology.us
[53] N. M., S. K., Shashank, T. N., & Dhruthi. (2021). Review—Different Ceramic Reinforcements In Aluminium Metal Matrix Composites. ECS Journal of Solid State Science and Technology, 10(5), 053003. https://doi.org/10.1149/2162-8777/ac0114
[54] Siddesh Kumar, N. M., Shashank, T. N., Khan, N., Mahendra Babu, K. J., & Ajit Prasad, S. L. (2021). Modal and Harmonic Analysis of Spur Gear using FEA. Journal of Failure Analysis and Prevention, 21(5), 1855–1865. https://doi.org/10.1007/s11668-021-01243-2
[55] Siddesh Kumar, N. M., Sadashiva, M., & Monica, J. (2022). Speculative Testament of Corrosive Behaviour of Aluminium Composite Welded by FSW (pp. 429–440). https://doi.org/10.1007/978-981-16- 4321-7_36
[56] Siddesh Kumar, N. M., Chethan, S., Nikhil, T., & Dhruthi. (2022). A review on friction stir processing over other surface modification processing techniques of magnesium alloys. In Functional Composites and Structures (Vol. 4, Issue 1). IOP Publishing Ltd. https://doi.org/10.1088/2631-6331/ac49f3
[57] Siddesh Kumar, N. M., Sadashiva, M., Monica, J., & Praveen Kumar, S. (2021). Investigation on Corrosion Behaviour of Hybrid Aluminium Metal Matrix Composite Welded by Friction Stir Welding. Materials Today: Proceedings, 52, 2339–2344. https://doi.org/10.1016/j.matpr.2022.01.362
[58] Sadashiva, M., Siddeshkumar, N. M., Monica, J., Srinivasa, M. R., Santhosh, N., & Praveenkumar, S. (2022). Hardness and Impact Strength Characteristics of Al based Hybrid Composite FSW Joints. International Journal of Vehicle Structures and Systems, 14(1), 13–17. https://doi.org/10.4273/ijvss.14.1.04
[59] Kumar, N. M. S., Kerur, M. R. H., Khan, N., & Shashank, T. N. (2022). Vibration analysis of healthy and faulty gear of parallel shaft drive system. AIP Conference Proceedings, 2463. https://doi.org/10.1063/5.0080184
[60] Siddesh Kumar, N. M., Dhruthi, Pramod, G. K., Samrat, P., & Sadashiva, M. (2022). A Critical Review on Heat Treatment of Aluminium Alloys. Materials Today: Proceedings, 58, 71–79. https://doi.org/10.1016/j.matpr.2021.12.586
[61] Murthy, L. N. H. R., Kurbet, R., Kumar, S. N. M., Jashwanth, K., & Bhargav, P. (2022). Parametric Based Influence of Silicon Carbide Particulates on Tensile and Hardness Characteristics of Graphitic Aluminium Copper Alloy. AIP Conference Proceedings, 2648. https://doi.org/10.1063/5.0118021
[62] Kumar, N. M. S., Shashank, T. N., Dheeraj, N. U., Dhruthi, Kordijazi, A., Rohatgi, P. K., & Sadashiva, M. (2023). Coatings on Reinforcements in Aluminum Metal Matrix Composites. International Journal of Metalcasting, 17(2), 1049–1064. https://doi.org/10.1007/s40962-022-00831-8
[63] Shankar C, G. M., Shivaprakash, Y. M., Kumar M, S. N., A, S. M., Dutta, A., & Professor, A. (2019). EXPERIMENTAL INVESTIGATION ON SILICON CARBIDE REINFORCED DURALUMIN BASED MMC PRODUCED BY COLD COMPACTING. In www.tjprc.org SCOPUS Indexed Journal editor@tjprc.org. www.tjprc.org
[64] G, R. H., Byregowda, H. v, & Kumar M, S. N. (n.d.). Optimization of ZnO Thin Films using Sol-Gel Dip Coating by Taguchi Method Section A-Research paper ISSN. In Eur. Chem. Bull. 2023 (Vol. 12, Issue 8). [65].
[65] M, S., Sheikh, M. Y., Khan, N., Kurbet, R., & Gowda, T. M. D. (2021). A Review on Application of Shape Memory Alloys. The International Journal of Recent Technology and Engineering (IJRTE), 9(6), 111–120. https://doi.org/10.35940/ijrte.F5438.039621
[66] B M, P. K., Baig, M. M. A., Dharawadmath, S. I., & C M, V. (2023). Review on Current Applications and Future Directions in Carbon Nanotubes for Cancer Therapy using AI. International Journal for Research in Applied Science and Engineering Technology, 11(9), 1087–1094. https://doi.org/10.22214/ijraset.2023.55787
[67] T, G., Kalal, P., N, P., M K, A., H, G., Dharawadmath, S. I., C M, V., & V, N. (2023). Modern Smart Street Light Monitoring Systems. International Journal for Research in Applied Science and Engineering Technology, 11(9), 1075–1084. https://doi.org/10.22214/ijraset.2023.55782



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

TOGETHER WE REACH THE GOAL

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY