International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

Control Method for Electric Vehicles' Rapid Charging Based on Artificial Neural Networks Utilizing Renewable Energy Sources for Smart Battery Thermal Management

KUKUDALA SRILAKSHMI[1], Dr.D.SRINIVAS[2]

[1]MTech Student, Dept of EEE, Ellenki College of Engineering and Technology, Hyderabad, TS, INDIA.

[2] Professor, Dept of EEE, Ellenki College of Engineering and Technology, Hyderabad, TS, INDIA.

Abstract— Sustainable or environmentally friendly transportation has been a driving force behind the development of new automobiles in response to rising public concern about air pollution. The broad adoption of battery-powered vehicles is anticipated to be accelerated by the development of rapid battery charging technologies that aim to minimize the amount of time that batteries need to be recharged. A rapid electric car charging system that is also connected to a self-sufficient DC microgrid that is powered by renewable energy sources is proposed in this research. To address the issue of power demand management in dynamic situations, this study develops a novel DNN-based control strategy that combines model predictive control, also known as MPC, with artificial neural networks (ANNs) instead of relying just on MPC. Fast direct current (dc) charging for electric vehicles (EVs) is supervised by AI (NN) that uses energy available from renewable sources with battery backup devices. A battery temperature management method is proposed to guarantee the safety and performance of EV batteries under harsh operating circumstances. After doing simulations and experiments under different operating circumstances, the results reveal that the suggested ANN MPC scheme outperforms the MPC controller.

In this piece, we look at a photovoltaic-grid hybrid system that uses a water pump and an induction motor (IM).

When transferring power, a straightforward dc-link voltage management method is used. When the water pump is not in use, the system's power is sent to the utility. Normally, it feeds the induction motor-driven water pump. Two current sensors & two voltage sensors are needed for this system to measure and estimate. Using a modified version of the space vectors modulation (SVM) method, the phase currents of induction motors are approximated from the dc-link current. Using a third-order integrator for flux estimate and an artificial neural network–based model reference adaptive system, this system is able to adjust the power flow according to demand and accomplish speed estimation. The speed of an IM-pump may be controlled via field-oriented control. The power transfer between the utility and the IM drive plus water pump is controlled by managing the dc-link voltage, which is achieved using a unit voltage generation method based on third-order integrators. This article discusses a photovoltaic-grid integrated system that uses an induction motor (IM) connected to a water pump. The system's appropriateness is supported by simulation results on the MATLAB/Simulink platform and by test results obtained with the aid of a prototype under different solar irradiance conditions.

When transferring power, a straightforward dc-link voltage management method is used. When the water pump is not in use, the system's power is sent to the utility. Normally, it feeds the induction motor-driven water pump. Two current sensors or two voltage sensors are needed for this system to measure and estimate. Based on the direct current (dc) link current, the induction motor currents of phase are computed using a modified space matrix modulation (SVM) approach. Using a third-order integrator for flux estimate and an artificial neural network–based model reference adaptive system, this system is able to adjust the power flow according to demand and accomplish speed estimation. The speed of an IM-pump may be controlled via field-oriented control. The power transfer between the utility and the IM drive and water pump is controlled by managing the dc-link voltage, which is achieved using a unit voltage generation method based on third-order integrators. This article discusses a photovoltaic-grid integrated system that uses an induction motor (IM) connected to a water pump. The system's appropriateness is supported by simulation results on the MATLAB/Simulink platform and by test results obtained with the aid of a prototype under different solar irradiance conditions.

When transferring power, a straightforward dc-link voltage management method is used. When the water pump is not in use, the system's power is sent to the utility. Normally, it feeds the induction motor-driven water pump. Two current sensors or two voltage sensors are needed for this system to measure and estimate. Based on the direct current (dc) link current, the induction motor phases are

Received: 20-06-2026 | Accepted: 25-07-2026 | Published: 31-07-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

computed using a modified space matrix modulation (SVM) approach. Using a third-order integrator for flux estimate and an artificial neural network–based model reference adaptive system, this system is able to adjust the power flow according to demand and accomplish speed estimation. The speed of an IM-pump may be controlled via field-oriented control. The power transfer between the utility and the IM drive and water pump is controlled by managing the dc-link voltage, which is achieved using a unit voltage generation method based on third-order integrators. The system's suitability is supported by results from simulations run on the MATLAB/Simulink platform and tests conducted on a prototype under different solar irradiance conditions.

The following terms are used to describe various concepts related to DC microgrids: fast electric vehicle charging, integration of renewable energy sources, model predictive control, power demand control, thermal management of batteries, experimental validation and simulation, system stability.

INTRODUCTION

Because of their capacity to integrate various renewable energy sources into the automotive industry, decrease fuel consumption, and lessen carbon footprints, battery-powered cars (EVs) are quickly replacing more conventional forms of transportation [1]. Thanks to advancements in battery technology, electric cars are now more realistic for long-distance trips as well as shorter ones. There are still some challenges, notwithstanding the positive results. To begin, it is somewhat inconvenient as charging an EV might take many hours. Additionally, many EV owners rely on public charging stations to refuel their cars since they do not have the infrastructure to do so at home. The extensive incorporation of EVs will place significant pressure on electricity supply infrastructure due to the high power consumption of these vehicles [2]. Adding additional stations for charging to the grid won't help the environment since most of the power comes from conventional power plants. The trans mission network's energy quality is negatively affected by electric car quick-charging. Due to disorganised electric car rapid charging activities, electrical supply centers are expected to grow increasingly even more unreliable and deteriorated. Refueling an ICE vehicle takes just minutes at a gas station, while filling up an EV might take hours. The simple solution of installing more outlets to increase capacity would not work since, in addition to energy demands, there is still an operational limitation that limits the total number pf charging facilities that may be expanded. We need to keep a few things in mind if we want EVs to be generally accessible for purchase. Electric vehicles' limited range concern is the main roadblock to their widespread acceptance. A significant goal in making EVs accessible to more people is reducing the duration of the charge. Multilocation recharging, in which employees are encouraged to charge at both their home and place of work, is one further solution that has shown promise in managing demand [3]. However, due to the difficulty in managing or regulating customer charging behavior, systems like these are only suitable in theory. This viewpoint suggests that the charge time might be shortened to 20-30 minutes using dc rapid recharging [4]. Filling up a petrol tank is presently faster than any electric vehicle.

REATED WORK :

"Energy vehicle charging using simultaneous cordless power and data transfer: Reviews,"

An increasingly important area of study in recent years has been the wireless charging for electric vehicles (EVs). When charging an electric vehicle wirelessly, the charging station and the vehicle must communicate data wirelessly. You may need to know the EV's identity, the charger's voltage, current, and battery state on the main side for it to work. Some examples of commercially available wireless communication systems that may facilitate this data sharing include Zigbee, Bluetooth, and 802.11. On the other hand, there are connectivity issues that might arise during communication, large and unpredictable transmission delays, and cybersecurity concerns brought about by these technologies. A plethora of wireless data transmission–based solutions informed by the power transfer wireless circuit have been put forth to tackle these difficulties. Wireless electric vehicle charging applications that use simultaneous cordless power and data transmission (SWPDT) are thoroughly covered in this article. Because of the power level and the high likelihood of running with noticeable misalignments and possibly with the EV in motion, this environment poses a challenge to SWPDT. To be more precise, we outline a taxonomy for SWPDT systems and examine six distinct factors to think about while developing such a system for electric vehicles. Based on these

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

three use cases, we can see how well various system configurations work: one, delivering optimal efficiency; two, coordinating bidirectional wireless charges; and three, dynamic charging. Additionally, we have investigated the potential of integrating the widely used electric vehicle charging infrastructure communication protocol, ISO 15118, with the open charging point protocol (OCPP).

"A DC battery that can be quickly reconfigured to improve the efficiency and adaptability associated with electric vehicle drive trains,"

Direct current (DC) microgrids are becoming increasingly important due to a number of

A primary inverter and permanently connected batteries make up the traditional electrically powered automobile (EV) battery drive train. In order to separate large batteries into smaller ones, this study suggests a new architecture that uses low-voltage transistors with field effect (FETs) as interfaces. A large amount of switching work may be removed from the main inverter by using the new DC link, which is called reconfigurable DC battery. Here are a few advantages: 1) Even with the extra parts, the suggested architecture lowers the overall loss. By shifting the modulation task from the main converter to the reconfiguration DC battery, which can produce an ideal high-frequency voltage waveform, the net loss is decreased. This allows the battery to save up to two-thirds of the switching activities performed by the main inverter. The most recent low-voltage transistors and tiny voltage steps for multilevel conversion make the additional semiconductor loss very insignificant when contrasted with the primary inverter's. 2) When compared to traditional space-vector modulation, the primary inverter's output waveform exhibits far less distortion—as low as 50%. The decrease in distortion is a result of the reconfigurable DC battery's ability to create significant parts of the total output voltage with multilayer accuracy, especially at the peak. Thirdly, the inverter's output voltage transients (d v /d t) are significantly reduced due to the multilayer output characteristics, which in turn minimize insulation & bearing stress in the motors. 4) The design circumvents the problem of weak cells being exposed in big, hard-wired battery packs. 5) Normally-off FETs eliminate the high voltage that is present in traditional hard-wired cells and the problems that come with it, such as in production, maintenance, and crashes. We show the suggested motor drive in action on an eight-battery module, three-kilowatt arrangement.

"Analysis of grid-connected batteries energy storage systems: their uses and interactions,"

Numerous grid functions, including voltage support, power arbitrage, frequency management, and more, have been made possible by battery energy storage systems (BESS). To fulfill operating needs while preserving battery life, advanced optimization and control techniques are used. The knowledge of battery utilization is limited due to inadequate data openness and a lack of knowledge about BESS applications, even if basic research has enhanced our understanding of battery properties. Focusing on use cases and component synergies, this article provides a summary of recent advances in BESS grid services. In order to get a better picture of the BESS activity profiles in grid applications, we first take a look at the parameters that define the hardware characteristics. Then, we provide a quantitative methodology to evaluate the long-term use pattern of BESS applications. There is an emphasis on the frequency control service and a summary of the cross-cutting integration with energy consumption, energy production, or energy storage. The development of the condition of charge, the condition of health, and the technological and economic research is also assessed by means of an extensive study of BESS grid uses throughout the last decade. This study improves the communication for BESS operations and links to technical as well as economic operations, such as research on degradation and optimization of battery usage, by providing a thorough evaluation of the BESS grid development and integration. It also offers a new way of looking at duty cycle analysis of BESS applications. It lays the groundwork for future application-oriented battery research while offering an overview of BESS use cases in grid applications..

"A thorough evaluation and analysis of how distribution networks set up charging stations for electric vehicles,"

More and more people are worried about the effect of greenhouse gas emissions and the scarcity of fossil resources, which has led to a change from gas-powered cars to battery-powered cars (EVs). Furthermore, new energy research has made great strides, which greatly enhances the feasibility of EVs. As a result, EVs have become well-known and are being embraced by many nations throughout the globe. Nevertheless, other problems, including inadequate charging infrastructure, uneven distribution, excessive prices, and an absence of charging stations, have emerged as a result of the fast expansion of EVs. One obstacle to the broad use of electric vehicles is the scarcity of charging stations. The number of public charging stations for electric cars (EVCSs) has increased,

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

nevertheless, as EVs gain popularity. In order to match the increasing demand for electric vehicles and facilitate the electrification of transportation networks, recent studies have concentrated on pinpointing the best sites for electric vehicle charging stations (EVCSs). Some of the most important problems with electric vehicles, including their high price tag and short range, may be alleviated with a robust EVCS network. Finding the optimal locations for EVCSs is an issue that researchers have tried to define using a variety of approaches, objective functions, and restrictions. The ideal locations for EVCSs are the subject of current research. In addition to meeting the increasing demand for electric vehicles, this undertaking aims to facilitate the shift to electrified transport networks. This article provides a comprehensive overview of optimization approaches that may be used to find the best solutions, taking into account the system of distribution (DS) load, environmental factors, and economic considerations related to electric vehicle (EV) charging. For the purpose of better comprehension, the study used a conventional IEEE 33-bus radial system of distribution (RDS) that could draw power from a wide range of sources. For optimal energy source location and capacity identification, the bird of prey search algorithm (BESA) & cuckoo identification algorithm (CSA) were used. Furthermore, in order to evaluate the efficacy of these methods, we are investigating EV charging methodologies, which include both the conventional charging technique (TCT) or the innovative charge technique (ICT). To show how different energy sources may work alone and in combination to lessen the impact of charging electric vehicles on the DS, the research examined 10 distinct scenarios. We pooled and extensively studied the data acquired from the empirical investigation.

"Online MPC of workplace electric vehicle charging using hybrid machine learning forecasts,"

In this paper, we provide a new method for predicting arriving time (AT), electrical consumption (ED), and plugging duration (PD) of individual electric vehicles (EVs) using a hybrid ML prediction for a given calendar day. Once the ML and persistence projections are in, a model forecasting control (MPC) method is used to reduce the charge provider's power costs. The hybrid Dl forecast MPC decreased monthly power costs and peak loads compared to a base case forecast that calculated costs for unconstrained L2 charging: Over the course of a 30-day summer case study, the base instance to ML MPC resulted in a 46.7% reduction in daily mean peak load, whereas perseverance to ML MPC brought about a 2.8% reduction. During an outdoor case study, expenses for utilities were reduced by 20.9% from the base case to the ML MPC and by 0.1% from persistence to the ML MPC. Results for a 30-day winter case study are comparable.

Methodology:

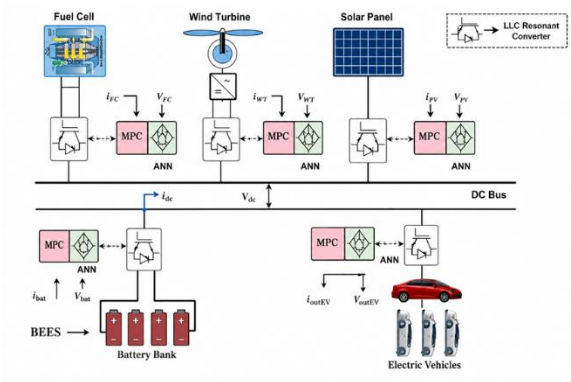


Figure 1: Scheme for rapid battery charging

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

Worldwide, energy consumption is on the rise, and there is an urgent need to reduce emissions of greenhouse gases. As a result, the hunt for sustainable and clean energy solutions has quickened. Sources of renewable energy (RES) such as wind, hydroelectricity, solar, geothermal, or biomass provide an alternative to conventional power generating methods that rely on nonrenewable fossil fuels. Solar, wind, and photovoltaic (PV) RES are the focus of this chapter as we investigate their potential integration into the proposed microgrid. We take a look at the theoretical underpinnings, practical aspects, power-generation potential, and control methods for making the most of these resources in order to build a reliable and long-lasting generator.

1.SUNLIGHT-BASE PHOTOVOLTAIC ENERGY

Solar photovoltaic (PV) energy is a very famous renewable energy source since it directly converts sunlight to electrical power using semiconductor materials. This section delves into the principles of operation, the parts of the system, the features of power production, and the aspects of integration of PV systems within the microgrid environment. Modus operandi excessivo (EPM):

1.2 Energy Conversion from Solar PV: The Basics

At its core, solar photovoltaic (PV) energy conversion is based on the photovoltaic effect, which is mechanical phenomena seen in certain materials where the absorption of light causes the formation of pairs of electron holes and the current to flow.

1.2 Microgrid Integration of Solar PV Energy

The proposed microgrid is an inexpensive and ecologically beneficial energy source that includes solar photovoltaic systems, which have several important advantages. Reduce your impact on the environment and your dependency on fossil fuels with solar PV power, a renewable energy source that is both abundant and clean. Electricity expenditures for microgrid users may be significantly reduced by using solar power, particularly during times of high price. An additional significant benefit is the increased autonomy in determining one's own energy needs; this is because solar PV systems provide a stable power supply, making them more resistant to power outages. The unpredictable nature of solar energy—affected by factors like weather and time of day—makes energy storage devices essential for microgrid operators to provide a consistent and continuous power supply.

1.3 Wind Power

Incorporating wind energy into the proposed microgrid is another significant renewable energy source. Wind turbines absorb the movement of the wind, convert it into mechanical energy, and finally into electrical power. Here we take a close look at wind energy systems and examine their components, operating principles, power-generating features, and integration challenges within a microgrid framework.

1.4 The Microgrid and Wind Power Integration

A green electricity system would not be complete without the planned microgrid, which would include wind power for its many advantages. Reducing reliance on fossil fuels and other harmful energy sources is possible with the aid of wind power, which is abundant, renewable, and clean. In addition, depending on the area's dependable and strong wind resources, wind turbines have the ability to generate a significant quantity of electricity. This is particularly the case when the rotor diameters are larger. An additional major perk is wind power, which is more efficient at night and in the winter when solar output is at its lowest. Wind energy has many benefits, but it is intermittent and subject to fluctuations in wind speed and direction, so careful preparation is required. A consistent and dependable source of electricity inside the microgrid can only be achieved with the integration of storage devices for energy storage or backup power sources, which are necessary to ensure the reliability and stability of the grid.

1.5 Methods for Managing Hybrid Renewable Energy Systems

Maintaining grid stability, optimizing power flow, managing hybrid energy from renewable sources systems, and maximizing energy efficiency all need reliable control methods. Power control management is an essential

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

strategy for balancing energy production and consumption by coordinating other energy sources or storage systems in response to real-time situations. Voltage & frequency control maintains a steady voltage and frequency in the microgrid by regulating the activity and inactivity of various power sources. Finding and regulating the microgrid's transition to islanding mode is crucial for ensuring uninterrupted operation and safeguarding critical loads in the event of grid outages. Integrating renewable energy sources, particularly wind and solar PV, into the planned microgrid is essential for its resilience and sustainability. A few of the many benefits of these abundant and clean resources are less reliance on fossil fuels, less emissions of greenhouse gases, more energy independence, and the possibility of cost savings. However, due to the intermittent nature of solar and wind power, complex management systems, integrated energy storage, and meticulous planning are necessary to provide a reliable and efficient energy supply.

2. THE PROCESS OF RECHARGING EVS

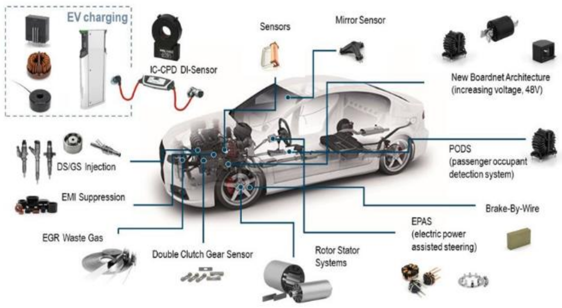
2.1 Electric vehicles are a novel concept: Electric drive vehicles, or just electric vehicles, are vehicles that get their power from electric or traction motors. There is a range of electrification levels in each vehicle. Figure 3.1 uses a scale of zero (a conventional automobile) to one (a fully electric car) to classify EVs. For the most part, there are three main types of electric cars.

3.1.2 Hybrid Electric Vehicles (HEVs)

The second kind is the Heterogeneous Electric Car (HEV), which integrates an ICE for use far from cities with an EM for low-speed in-city travel; Figure 3.2.B shows this in action. In ICE mode, the EM turns off and the alternator starts charging the batteries using the same installed ICE. The latest version of the Plug-in Prius Electric Car (PHEV) has an improved method for charging the batteries from the outside. As a backup, the combustion engine kicks in when the batteries die and the driver can't escape for a while to recharge. The new Porsche Plug-in S hybrid system, which takes the place of the old Panamera Hybrid, is an improvement over its predecessor in terms of both performance and reaction time behind the wheel.

3.1.5 Solar-powered electric vehicles

A solar vehicular (SEV) is a kind of electric vehicle that gets most or all of its electricity from sunlight. Mounted atop the car, solar arrays, usually made of photovoltaic (PV) cells, convert solar energy into electric power instantly. Because it is the only source, converted solar energy powers all or part of the ancillary components of SEVs, including the propulsion, electronics, messaging, navigation, and security systems. Similar to conventional vehicles, sensors assist the driver. Here, the data obtained allows for the tracking of several parameters, including the vehicle's energy use and solar energy harvesting.



A Synopsis of Electric Vehicle Components (Figure 3.1).

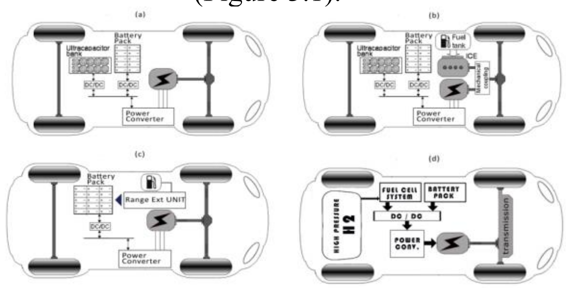
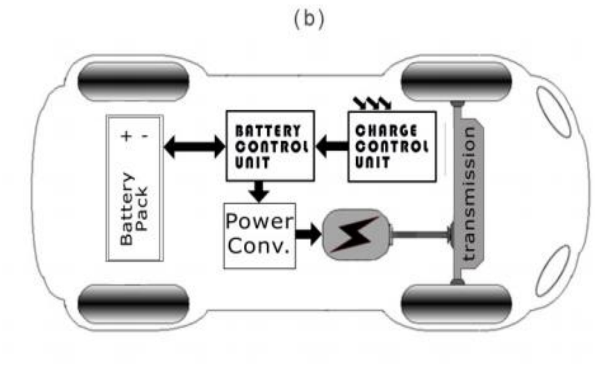


Figure 3.2: Common Electric Vehicles' Simplified Drivetrain Architectures (A): Battery Vehicles (B): Hybrid Electric Vehicle (C): Electric Vehicle with Extended Range (D): Electric Vehicle with Fuel Cells.

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper



Enhanced Sunroof for SEVs Utilizes CPV Technology (Figure 3.3 (A)). (B) Solar-powered EV's Condensed Drive Train Design.

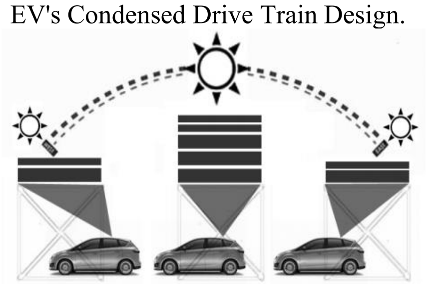
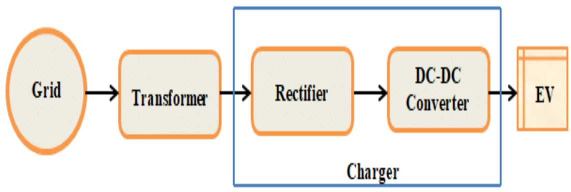


Figure 3.4: C-Max Selective Surface-Emitting Diode Charging System with Concentrating Parking Lenses and Concentrating Photovoltaic Panels.

3. A Location to Charge Electric Vehicles

Electric car charging stations are insufficient. You may find charging stations in two distinct varieties: public and private. The government has installed a modest number of charging stations in different cities in emerging countries, while the vast majority of terminals are private. There has been an increase in the rate of charging at some private stations. Figure 3.5 shows a block diagram of an EVCS, broken down into its component parts: the transformer, rectifier, and converter. The two main components of an electric vehicle charger are the rectifier and the converter. the available specs of the EVs.



Vehicle electric charging station block schematic (Figure 3.6).

Electric Vehicle Specifications in India: A Table

Parameter	Easy Bike and Auto-Rickshaw	Electric Motorcycle
Power	500–1000 W	1200–2500 W
Voltage	36/48/60 V	60/72 V
Battery	20–30 Ah	20 Ah lead-acid gel battery
Charging time	6–7 h	6–8 h
Maximum speed	30–40 km/h	50–80 km/h
Driving distance	70–100 km	60–80 km

We need to look at the implications of EVs since EV loads are increasing daily. How the electrical system is impacted by the widespread EV penetration is shown in Fig. 2 below. However, with the ability to minimize emissions of greenhouse gases and integrate with smart grid technologies, EV adoption remains the most cost-effective mode of transportation. The electrical system network, however, will suffer significant negative consequences..

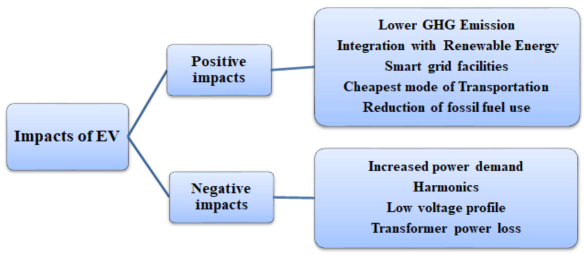
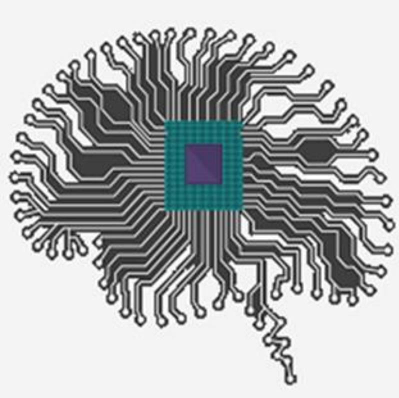


Figure 3.7: The Effects of EVs.

4. Deep Learning Systems:

This tutorial on artificial neural networks (ANNs) covers both the fundamentals and more advanced topics. Anyone from complete newbies to seasoned pros may benefit from our artificial neural networks course..

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

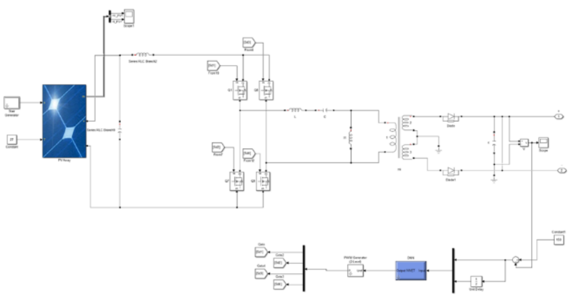


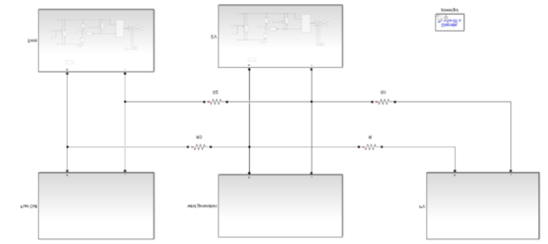
An AI subfield that takes its cues from the brain, "artificial neural network" describes this kind of system. Computer networks that mimic the way the human brain's neural networks operate are known as artificial neural networks (ANNs). Neural networks in artificial intelligence function in a way similar to the way neurons in the human brain are linked together in different levels of the network. The term "node" describes these neurons.

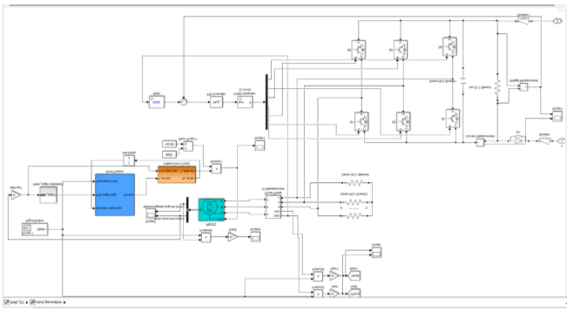
Modelling Foreign Direct Investment:

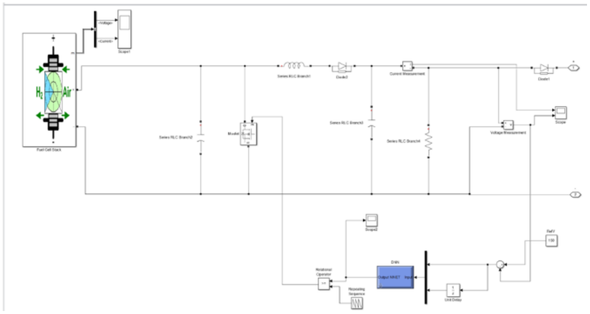
Methods for fault detection and isolation that rely on models of the system are known as model-based FDI approaches. You may use math or expertise to build the system model. Approaches based on observers, parity-space, and parameter identification are among the model-based FDI strategies. An further development in model-based FDI schemes is the set-membership approach. These techniques ensure that, under certain circumstances, defect detection will occur. What sets these methods apart is that they skip over models that don't fit the data, rather than trying to determine which one is most probable..

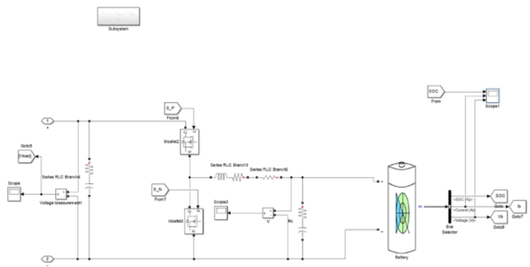
RESULT S :











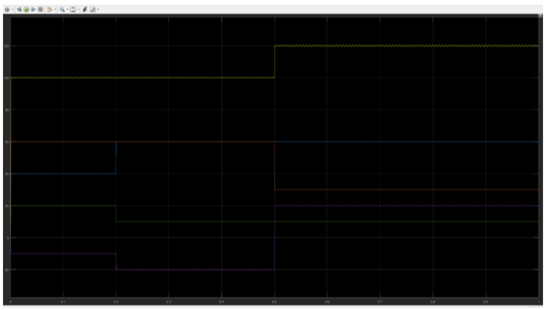
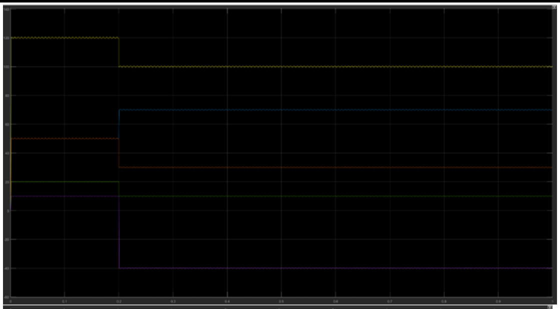
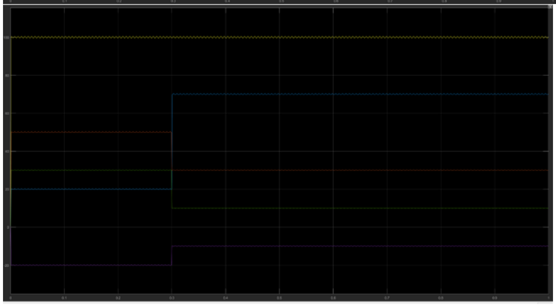


Fig 12

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper





CONCLUSION

Electric mobility is seen as a vital platform that influences national development, both the economy and the environment. Use of clean, eco-friendly power is one intentional strategy to lower global emissions. This study developed a novel energy management scheme for a Wind-FC-PV as well as ESS-powered smart charge facility based on ANN and MPC to decrease carbon emissions, improve charging infrastructure efficiency, and decrease charging times for electric vehicles in remote areas. The network's ability to withstand disruptions caused by variations in green energy and their system on a chip (SoC) is critical to the system's smooth operation. Charging infrastructure and wait times, especially during busy periods, are to blame for longer than expected wait times. The control approach being utilized is designed to determine when to start charging electric vehicles, at what power, and with what mix of sources in order to maximize the capacity of sources of renewable energy used for direct current rapid battery charging and reduce the overall period required to replenish. A higher proportion of energy will be accessible to the nations in the long run, and the broad adoption of electric cars will be aided by this. At elevated outside temperatures as well as in charge-discharge sequences, a dynamic BTMS in conjunction with PCM or fluid refrigeration is proposed as a solution to the problems associated with battery thermal management. From whatever the authors have shown in [23] and [33], it is clear that AI-powered EV acceleration control is more effective and accurate than MPC. This is supported by experimental and simulation findings. Possible future research directions include determining the optimal sequence for fast wireless charging and assessing the present ANN model.

REFERENCES

[1] I. "A review of simultaneous wireless data and electricity transfer with electric vehicle charging" published in the June 2024 issue of the IEEE Transactions on Transportation and Power, by Casaucao Tenllado, A. Triviño Cabrera,, and Z. Lin.

[2] Z. Li et al., “A rapidly reconfigurable DC battery for increasing flexibility and efficiency of electric vehicle drive trains,” IEEE Trans. Transport. Electrific., vol. 10, no. 2, pp. 2322–2331, Feb. 2023.

[3] M. A. H. Rafi and J. Bauman, “A comprehensive review of DC fast-charging stations with energy storage: Architectures, power con verters, and analysis,” IEEE Trans. Transport. Electrific., vol. 7, no. 2, pp. 345–368, Jun. 2021.

[4] A. Abuelrub, F. Hamed, J. Hedel, and H. M. K. Al-Masri, “Feasibility study for electric vehicle usage in a microgrid integrated with renewableenergy,” IEEE Trans. Transport. Electrific., vol. 9, no. 3, pp. 4306–4315, Sep. 2023.

[5] F. Z. U. Abideen, H. A. Khalid, M. S. Khan, H. Rehman, and A. Hasan,“Direct model predictive control of fuel cell and ultra-capacitor basedhybrid electric vehicle,” IEEE Access, vol. 12, pp. 46774–46784, 2024.

[6] C. Zhao, P. B. Andersen, C. Træholt, and S. Hashemi, “Grid-connected battery energy storage system: A review on application and integration,” Renew. Sustain. Energy Rev., vol. 182, Aug. 2023, Art. no. 113400, doi:10.1016/j.rser.2023.113400.

[7] O. Bamisile, Z. Zheng, H. Adun, D. Cai, N. Ting, and Q. Huang,“Development and prospect of flywheel energy storage technology: A citespace-based visual analysis,” in Proc. Int. Conf. Power Elect. Eng. (ICPEE 2022), 2023, doi: 10.1016/j.egyr.2023.05.147.

[8] B. Shen et al., “Superconducting magnetic energy storage (SMES) for urban railway transportation,” IEEE Trans. Appl.

Received: 20-06-2026 | Accepted: 25-07-2026 | Published: 31-07-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

Supercond., vol. 34,no. 8, Nov. 2024, Art. no. 5701304.
[9] N. Poursafar, S. Taghizadeh, M. J. Hossain, and M. Karimi-Ghartemani, "A voltage-supportive controller for ultra-fast electric vehicle chargers in islanded DC microgrids," J. Mod. Power Syst. Clean Energy, vol. 11,
no. 3, pp. 896–906, May 2023.
[10] T. Yuvaraj, K. R. Devabalaji, J. Anish Kumar, S. Babu Thanikanti, andN. I. Nwulu, "A comprehensive review and analysis of the allocation of electric vehicle charging stations in distribution networks," IEEE Access,
vol. 12, pp. 5404–5461, 2024.
[11] K. S. Nisha and D. N. Gaonkar, "Model predictive controlled three level bidirectional converter with voltage balancing capability for settingup EV fast charging stations in bipolar DC microgrid," Electr. Eng., vol. 104, no. 4, pp. 2653–2665, Feb. 2022, doi: 10.1007/s00202-022 01492-w.
[12] F. Jiao, Y. Zou, X. Zhang, and B. Zhang, "Online optimal dispatch based on combined robust and stochastic model predictive control for a microgrid including EV charging station," Energy, vol. 247, May 2022,Art. no. 123220, doi: 10.1016/j.energy.2022.123220.
[13] Z. Zheng et al., "Dual model predictive controlled hybrid energy storagesystem for naval DC microgrids," IEEE Trans. Transport. Electrific., vol. 9, no. 1, pp. 156–168, Mar. 2023, doi: 10.1109/TTE.2022.3177296.
[14] P. Xie, "Mixed-stage energy management for decentralized micro grid cluster based on enhanced tube model predictive control," IEEE
Trans. Smart Grid, vol. 12, no. 5, pp. 3780–3792, Sep. 2021,
doi10.1109/TSG.2021.3074910.
[15] X. Zhang, Y. Wang, X. Yuan, Y. Shen, Z. Lu, and Z. Wang, "Adaptive dynamic surface control with disturbance observers for
battery/supercapacitor-based hybrid energy sources in electric vehicles," IEEE Trans. Transport. Electrific., vol. 9, no. 4, pp. 5165–5181,
Dec. 2022, doi: 10.1109/TTE.2022.3194034.
[16] K. Wang, J. Yang, C. Zhang, F. Wen, and G. Lu, "Joint energyfrequency regulation electricity market design for the transition towardsa renewable-rich power system," Int. J. Electr. Power Energy Syst., vol. 155, Jan. 2024, Art. no. 109504.
[17] G. McClone, A. Ghosh, A. Khurram, B. Washom, and J. Kleissl,
"Hybrid machine learning forecasting for online MPC of work place electric vehicle charging," IEEE Trans. Smart Grid, vol. 15, no. 2, pp. 1891–1901, Mar. 2024.
[18] B. Wang, P. Dehghanian, and D. Zhao, "Coordinated planning of electric vehicle charging infrastructure and renewables in power grids," IEEE Open Access J. Power Energy, vol. 10, pp. 233–244, 2023.
[19] B. Adineh, M. R. Habibi, A. N. Akpolat, and F. Blaabjerg, "Sensor less voltage estimation for total harmonic distortion calculation usingartificial neural networks in microgrids," IEEE Trans. Circuits Syst. II,
Exp. Briefs, vol. 68, no. 7, pp. 2583–2587, Jul. 2021.
[20] Z. J. Lee et al., "Adaptive charging networks: A framework for smart electric vehicle charging," IEEE Trans. Smart Grid, vol. 12, no. 5,pp. 4339–4350, Sep. 2021.