International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING
IJISAE
ISSN:2147-6799 www.ijisae.org Original Research Paper

A Hybrid Algorithm for Integration of V2G and G2V with Photo-Voltaic on Power Quality Enhancement

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Submitted:14/03/2024 **Revised**: 29/04/2024 **Accepted**: 06/05/2024

Abstract: The combination of Photovoltaic (PV) systems and Electric Vehicles (EVs) into the grid has witnessed remarkable progress, which is driven by the dual benefits of reduced pollution and lower energy costs. Extensive studies have explored the implications of using the combination of PV and EVs into the grid on diverse applications. As PV and EV penetration rises, the grid experiences the collective impacts of this integration. The primary factor behind the integration of photovoltaic (PV) technology in Vehicle-to-Grid (V2G) and Grid-to-Vehicle (G2V) services is the cost reduction which achieved through energy discharging. However, a crucial requirement is maintaining a reasonable distance between EV battery degradation and its driving limit. Therefore, this research introduces a hybrid technique combining Mexican Axolotl Optimization (MAO) and Pilot Pattern Selection (PPS) technique to optimize the power stability between the components and to adapt the system whenever there is a change occurs. MAO can quickly converge on the best pilot pattern selection technique by offering a set of well-designed pilot patterns that represent different controller switching patterns. The MAO doesn't have to examine into wide area using possibly inefficient strategies. The optimal pilot pattern selection methodology reduces switching time and improves energy management by identifying the best way for selecting patterns from a predetermined set. Additionally, through utilizing the DOA, the reliability of the MAO increases in its convergence towards the optimal solution. So, the algorithm's each Dingo agents move within a hypercube in the search space around the best possible solution thus helps to balance grids and control the frequency. The simulation results shows that the THD of the recommended method is less (0.29%) and high efficiency (99.77%), $P_{int\ peak}$ (97.8), $P_{extractd}$ (97.5), $V_{dc\ peak}$(850) and V_{dc}(750) with minimum settling time (17.12), undershoot (0.0211) and overshoot (0.214) when compared to other conventional models such as Salp Swarm Algorithm (SSA) and Dual Active Full Bridge (DAFB). Through the simulation results it clearly demonstrates that, this research optimizes PV self-consumption while preserving crucial power quality attributes such as power factor, harmonics, and grid voltage/current.

Keywords: *Electric Vehicles, Grid-to-Vehicle, Improved Mexican Axolotl Optimization, Photovoltaic Systems, Vehicle-to-Grid*

1. Introduction

The increasing adoption of electric vehicles (EV) poses a huge challenge to the electrical grid, which modifying its ability frequently to satisfy demand while maintaining stability [1]. Furthermore, the growing amount of EVs imposes additional pressure on elements of the distribution system such as transformers and cables, during periods of peak demand. Integrating EV charging with Renewable Energy Sources (RESs) such as solar and wind [2] can help to offset these effects. RESs can meet the majority of the power demand for EV charging and minimizing grid dependence. EVs can simultaneously stabilize irregular RESs by addressing concerns such as voltage and frequency instability [3]. Due to similar properties, photovoltaic (PV) generation among diverse RESs enables considerable flexibility for integration with EV charging stations [4]. PV and EVs both link to the grid in a scattered fashion and at comparable voltage levels, making them compatible. This similarity extends to the areas where they are installed, which include residential residences, public charging stations [5], business buildings [6], offices [7], and even solar EVs [8]. Furthermore, both PV and EVs use power electronic interfaces [9] to generate intelligent nodes in the grid.

Existing rules and standards for PV systems are apply to EV systems with minor revisions, thus demonstrating the grid's interoperability with both technologies. When PV systems and Level 2 (L2) AC chargers [10] are combined, they share a common AC bus to connect to the power grid. This setup adds new obstacles to the PV system's grid-tied DC-AC inverter [11-13]. The inverter requires precision management to control the DC-bus voltage, synchronize with the grid, and reduce power quality problems in the face of fluctuating environmental circumstances impacting generation and unexpected changes in EV loads. In grid-connected PV systems, a Voltage Source Inverter (VSI) [14] with internal current and external voltage loops for active and reactive current control and DC-link voltage regulation is typically used. While the prior models are frequently sensitive to power line inductance and switching frequency. This study describes a novel tuning technique for the grid-tied DC-AC inverter's Proportional-Integral (PI) controller [15], which supports an EV charging station using AC L2

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ports. The performance of the controller is tested using simulations using different performance metrics. The major contributions of the present research are given below,

- The research introduces a hybrid technique named MAO-PPS for effective energy distribution among the PV system, ESU, and the grid.
- The suggested architecture integrates ESUs and the grid for the storage of PV energy.
- The MAO-PPS controller manages the current from the Maximum Power Point Tracking (MPPT) converter and the voltage from the DC bus.

The paper is organized as follows: Section 2 discusses the importance of previous researches. Section 3 provides an overall description of the proposed approach, which is used to optimize controller parameters. In Section 4, evaluation and the findings achieved by proposed method is given. The present research is concluded in Section 5.

2. Literature Survey

To obtain the optimal mixture of control settings for a VSI, Mohamed et al. [16] proposed an optimization technique. It was a shared grid-connected ac-bus that connected a PV to an EV charging station. Maintaining a balance between active power flow as well as injection of harmonics into the grid, the optimization process aims to minimize oscillations in the dc-bus voltage. This is achieved through the utilization of the Salp Swarm Algorithm (SSA). This research tests the controller using real-world irradiance profiles while simulating a L2 AC charging station for electric vehicles under different operational circumstances. The findings indicated a substantial reduction in the dc-bus voltage error with the use of SSA-based controller. However, the suggested approach performed worse in real-time Power-In-the-Loop (PIL) testing, which is a result of power supply delays.

Bourenane et al. [17] presented a hybrid energy system including a battery as the primary supply and a supercapacitor (SC) as a backup to solve the constraints of the former. This hybrid design required a sophisticated power management system to maintain optimal power flow in electric vehicle components. To do this, an artificial neural network (ANN) is trained using model calculations for power management in the traction chain. Simulation findings of the proposed hybrid system emphasize its usefulness in safeguarding the battery and supercapacitor life cycles, absorbing energy variations from the PV panel, and functioning as a secondary energy source in the event of faults. However, it's worth mentioning that the usage of ANNs consumed large computational resources, and more power, thus potentially providing difficulties for real-time onboard implementation.

Akarne et al. [18] proposed an effective model and robust control strategy to ensure optimal power quality in an AC Micro Grid (MG). A PV and a Wind Turbine System (WTS) with a permanent magnet synchronous generator (PMSG) are the two renewable energy sources that make up the MG. The MPPT is based on the perturb-and-observe (PO) approach, which was used to improve efficiency and overall performance. The PO approach improved the operating voltage of the PV using minor disturbances to determine the maximum power point (MPP). However, it is recognized that the PO technique may display slow convergence and system oscillations around the MPP, mainly during fast changes in irradiance levels.

To increase the PV system's output power, Kumar and Rajan [19] developed a unique solution using a High Gain Zeta-SEPIC (HGZS) converter. A major novelty was the creation of a Type 2 Fuzzy MPPT controller, thus ensuring exact tracking of the MPP. This improvement raises the performance of the HGZS through increasing energy extraction from the PV. The proposed Hybrid Renewable Energy System (HRES) not only supports the utilization of EVs as a reasonable transportation choice but also contributes in minimizing greenhouse gas emissions. However, the complex control requirements of this system necessitate advanced algorithms, thereby creating complexity in the implementation process.

To transfer power between the grid, battery and EV, Jatoth and Mangu [20] developed a DAFB module. With the help of Phase Shift Modulation (PSM) method, the DAFB circuit topology controls the G2V and V2G conditions. The PV array was optimized for EV battery charging utilizing β-MPPT to harvest maximum power. The variations in battery current directions suggest that the same DAFB circuit functioned as a bidirectional power-sharing module. It is also shown that the efficiency under the G2V and V2G circumstances is maintained at an acceptable range for any power system.

Merrington et al. [21] developed an effective technique for ideal planning of a solar PV and battery storage system (BSS) customized for owner households with EVs under time-of-use (TOU) power pricing. The major objective of this optimization was to minimize the Cost of Electricity (COE) while following to design restrictions across a 20-year project lifecycle. Stochastic functions are incorporated into the energy management system by considering the EV's availability hours, departure and arrival, and its initial state-of-charge. Notably, the study indicated that the ideal capacity of SPV and BSS remains unchanged by fluctuations in the battery capacity of the EV. However, an important shortcoming was the elimination of demand response programs inside the TOU pricing tariffs in the suggested system. Thus results a major tradeoff between the grid and PV power supply to EV.

3. Proposed Methodology

3.1. Outline of PV-EV-Grid

Daytime overload specifies a challenge as EVs experience interruptions in continuous charging, thus leads to user uncertainty. Combining grid-connected charging with battery and photovoltaic charging tackles this issue successfully. The recommended approach guarantees seamless EV charging, rapidly addressing requests while eliminating additional grid strain. The suggested system uses optimization strategies in its control algorithm development. Unlike existing models with restrictions of increased load during continuous charging and lower battery lifespan, the described technique merges V2G and V2V processes for continuous daytime EV charging. Simulations are undertaken to estimate the charging strategy's potential impact, and controllers play a critical role in reducing load on the grid. The concise flow diagram of the proposed method is illustrated in Fig. 1.

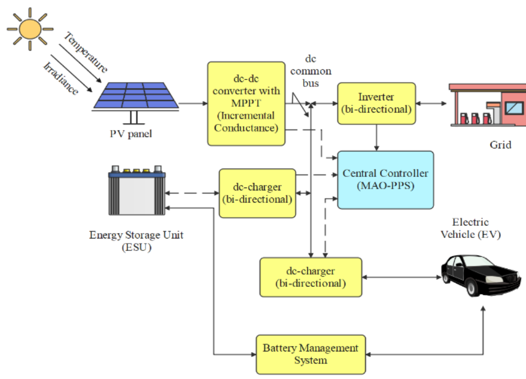

Fig. 1. Diagrammatical representation of proposed methodology

As indicated in Fig. 1, the PV-grid charging system has three basic elements: (1) an Incremental conductance which is a MPPT dc–dc converter, which works as a dc to dc power converter, (2) bidirectional inverter, and (3) bidirectional dc charger. To boost stability and address the recurrent nature of renewable sources, researchers generally suggest the installation of an ESU in the system. Although the ESU delivers various benefits, it comes with high startup, operating, and maintenance expenditures. Nonetheless, the usage of cost-effective lead acid batteries can assist lower the initial expense. Integration of a BMS is advised for assuring safety and prolonging the battery life of EVs. The dc common bus plays a crucial role in offering a convenient integration link for key components. Although its voltage can vary among systems, a typical range is 200–400 V. The system incorporates a central controller for adopting a centralized or decentralized coordinated charging. This controller gathers data based on the grid, EV, PV, and ESUs, for facilitating automated decision-making. The controller effectively manages converters, and making decisions based on power flow direction to ensure seamless integration and operation.

3.1.1. Photovoltaic Module

Photovoltaic modules are actually solar panels [22] which work as a network to collect sunlight and turn it into clean electricity. The semiconductor material is essential to each solar cell that makes up these modules. These cells have the ability to produce electricity when exposed to sunlight, a phenomenon known as the photovoltaic effect. Solar panels are an important technology for utilizing clean and renewable power sources since the photovoltaic effect is essential in converting solar radiation into usable electrical energy which is mathematically expressed in (1).

$$I = I_{ph} - I_D - I_{R_S} + I_{R_{SH}} \quad (1)$$

Where,

I - output current from the PV cell.

I_{ph} - photocurrent generated by the incident light.

I_D - diode current, representing the effects of the p-n junction diode in the PV cell.

I_{R_S} - current flowing through the series resistance.

$I_{R_{SH}}$ - current through the shunt resistance

3.1.2. DC-DC Boost Converter

The PV panel generates purely DC power because the electrons pass only in single direction during generation. On a normal day, the intensity of solar radiation changes from 200W/mt2 – 1000 W/mt2 which determines the density of electrons. Hence the panel output power is directly proportional to the solar irradiation in a day which changes depending on the intensity. Therefore the voltage of panel should be stabilized by using the external circuit topology and maximize the magnitude based on the requirement. For this purpose, a DC-DC boost converter is used and it is controlled by MPPT controller.

3.1.3. Inverter

In rectifier mode, an inverter acts as an energy converter, by converting electricity from DC to AC and vice versa. The even number of inverters was chosen on purpose to allow for their hypothetical parallel installation across the settlement. According to simulation studies, using a parallel inverter design increases dependability, improves load management, and improves overall efficiency.

3.1.4. Energy Storage Units (ESUs)

Electric vehicles have systems or components called ESUs that can store electrical energy for use at a later time [23]. An ESU's principal function in an electric vehicle is to collect and store energy produced during charging or regenerative braking, and then to transmit that energy to the electric motor of the vehicle as and when it is required. The

ESU in an EV is generally a rechargeable battery pack, and the type of battery technology utilized can vary. Due to the high energy density and efficiency, the lithium-ion batteries are being a popular choice.

3.1.5. Grid

An electrical grid is an integrated system containing power generating, transmission, and distribution networks. It supplies electricity seamlessly to households, businesses, and industries. Power plants create electricity [24], high-voltage transmission lines carry it, and local distribution systems provide end-users. Grid operators control its real-time operation, thus ensuring stability and balance. The grid is vital for delivering a dependable and continuous electrical supply to society [25].

3.2. Proposed Methodology

The research introduces a hybrid technique as a combination of Mexican Axolotl Optimization (MAO) and Pilot Pattern Selection (PPS) technique to optimize the power stability between the components and to adapt the system whenever there is a change occurs. Even though the MAO can modify the impact of various processes throughout the optimization process. If the initial population does not include a wide variety of possible solutions, MAO falls in local optima. This indicates that while it cannot able to find the optimal solutions, it converges on a good solution which found within a constrained search space. Therefore, MAO can quickly converge on the best pilot pattern selection technique by offering a set of well-designed pilot patterns that represent different controller switching patterns. The MAO doesn't have to examine into wide area using possibly inefficient strategies.

Pilot patterns are predefined set of steps which to be performed prior to controller switching. Through training the system for the new controller, each pilot pattern mitigates the effects of the transition. The optimal pilot pattern selection methodology reduces switching time and improves energy management by identifying the best way for selecting patterns from a predetermined set. Firstly, as the algorithm develops, the method focuses on generating the input patterns; the inverse probability of transition is applied to avoid high convergence. This minimizes the time required for the system to achieve a stable condition, and also helps in a quicker settling time.

The Mexican Axolotl is commonly found in the Valley of Mexico's lakes and shallow streams, which exhibiting remarkable regenerative abilities for separated body parts. This algorithm incorporates distinct things such as axolotl's reproductive capacity, tissue regeneration, and aquatic lifestyle, even distinguishing between male and female individuals. Significantly, the proposed MAO-PPS algorithm surpasses existing optimization approaches in its ability to identify global solutions, showcasing superior performance in optimizing the model for system stability [26].

The step by step process of MAO-PPS is as follows,

Step 1: Initialization

IMA algorithm begins with the initialization of its parameters to set the foundation for the optimization process.

Step 2: Random Generation

Following initialization, input vectors are produced randomly and forming the initial candidate solutions.

Step 3: Fitness Evaluation

The fitness of each candidate solution is determined based on the switch control/decision making as shown in (2).

$$Fitness_{Function} = Optimization\ [\mu\{\hat{I}_{rx}\}] \tag{2}$$

Step 4: Transition Phase

Considering a transition parameter represented as α, where mbest denotes the male axolotl reaching the greatest value F in the objective function. This value, ranging from 0 to 1, serves the function of altering the hue of male axolotl mj's body parts. The adjustment is implemented to align with the colors of mbest, as described in (3).

$$m_{ji} \leftarrow m_{ji} + (m_{best,i} - m_{ji}) \times \lambda \tag{3}$$

Female axolotls involve a color metamorphosis as they transition from larval to adult stages, by adjusting their pigmentation to that of the female axolotl with the most efficient acculturation where this adjustment is regulated by (4).

$$f_{ji} \leftarrow f_{ji} + (f_{best,i} - f_{ji}) \times \lambda \tag{4}$$

To avoid high convergence to the optimal adaptation in every person, the idea of inverse probability of transition is applied. Random selection of dummy individuals involves generating a random number (n) within the range [0, 1] and comparing it with the inverse transitional probability. If n is below the inverse probability, the corresponding individual is chosen. In the scenario of a minimization problem, the inverse probability of transition for the male axolotl (m_j) is determined using (5), where m_{oj}signifies the optimization value of the male axolotl. Similarly, for a female axolotl (f_j), (6) is employed to compute the inverse probability of transition, with f_{oj} indicating the optimization value of the female axolotl. During this procedure, the worst individuals have a higher probability of random transitions.

$$pm_j = \frac{m_{oj}}{\Sigma m_{oj}} \tag{5}$$

$$pf_j = \frac{f_{oj}}{\Sigma f_{oj}} \quad (6)$$

The selection of individuals, each undergoing a random transition of their i^{th} body component based on the function defined in (7) and (8). The criteria for choosing individuals for these random shifts will be defined by using optimization function's value.

$$m_{ji} \leftarrow \min_i + \left(\max_i - \min_i\right) \times n_i \quad (7)$$

$$f_{ji} \leftarrow \min_i + \left(\max_i - \min_i\right) \times n_i \quad (8)$$

Where,

n_i - randomly generated value within the range [0, 1].

Step 5: Updating the adaptive position based on Dingo Optimization Algorithm (DOA)

Utilizing the DOA, the reliability of the MAO increases in its convergence towards the optimal solution. The mathematical model of updation of DOA based adaptive position is given in (9-15)

$$\vec{R}_d = \left|\vec{P} \cdot \vec{S}_p(x) - \vec{S}(i)\right| \quad (9)$$

$$\vec{S}(i+1) = \vec{S}_P(i) - \vec{Q} \cdot \vec{R}(d) \quad (10)$$

$$m_{ji} \leftarrow m_{ji} + \vec{A}(m_{best,i} - m_{ji}) \times \lambda \quad (11)$$

$$f_{ji} \leftarrow f_{ji} + \vec{B}(f_{best,i} - f_{ji}) \times \lambda \quad (12)$$

$$\vec{A} = 2 \cdot \vec{a}_1 \quad (13)$$

$$\vec{B} = 2\vec{b} \cdot \vec{a}_2 - \vec{b} \quad (14)$$

$$\vec{b} = 3 - (i \times (\frac{3}{i_{max}})) \quad (15)$$

The algorithm's each Dingo agents move within a hypercube in the search space around the best possible solution.

Step 6: Injury and restoration phase

Axolotls can sustain injuries and accidents while swimming. If the possibility of harm (Pd) for each axolotl Si in the population is realized, there is a possibility of experiencing limited or whole loss of one or more body parts. Following that, the axolotl begins the regeneration process for the lost body part based on the regeneration probability per bit (Pr). As shown in Eq. (16), the replacement of the missing body part is determined by a function of P′ ij.

$$P'_{ij} \leftarrow \min_i + (\max_i - \min_i) \times n_i, 0 \le n_i \le 1 \textit{for each body part} \quad (16)$$

Step 7: Population Reproduction

A randomly selected male axolotl pairs with each female axolotl to facilitate offspring production. In the pairing process, the female axolotl collects spermatophores using her cloaca and deposits them into her spermatheca. Subsequently, the chosen male axolotl participates in the depositing process. To generate two eggs, each mating partner contributes genetic features uniformly. The female lays the eggs and watches them hatch. Newly hatched larvae vie with their parents for admittance into the colony. The parents get replaced if the young offspring outperforms them in the optimization process.

Step 8: Return-Best Position of the Solution

Step 9: End

4. Result and Discussion

To validate experimental results in the construction and evaluation of PV-grid-EV systems, this research employs MATLAB programming, primarily MATLAB R2022a. MATLAB supports the thorough assessment of PV-grid-EV functions when run on a Windows 11 configuration with an i9 processor and 32GB of RAM. The study investigates various ways for utilizing V2G-G2V integration to assist EV charging throughout the day. The proposed ideas are intended to improve the charging station's ability to provide a consistent and stable power supply. Fig. 2 shows a detailed Simulink depiction that provides a visual overview of the complete analytical process.

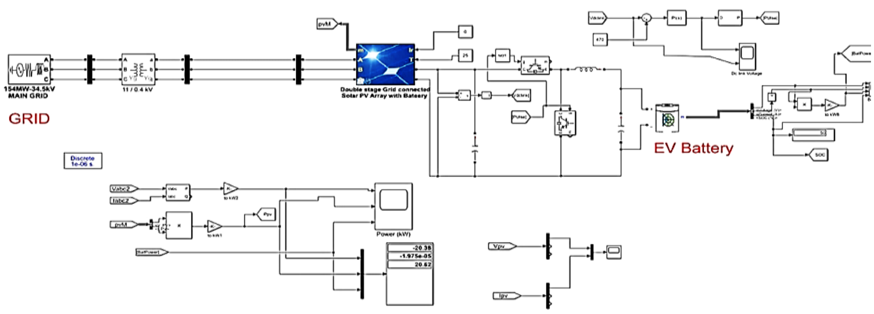

Fig. 2. MATLAB depiction of proposed method

Fig. 3 and 4 show the PV power extracted with MAO and IMOA controllers. The figures also provide several performance measures, including as voltage and duty cycle numbers.

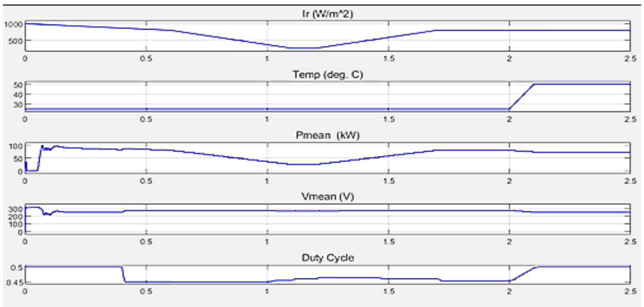

Fig. 3. Extracted power for MAO

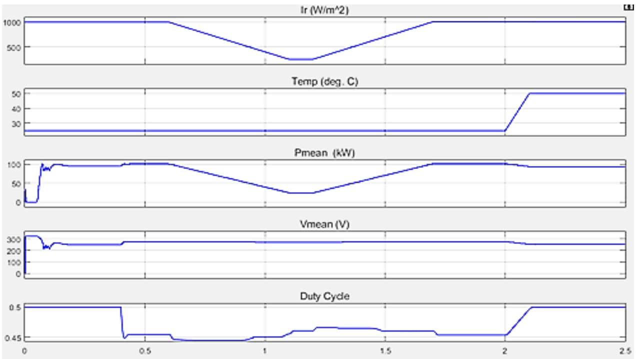

Fig. 4. Extracted power for MAO-PPS

4.1. Performance Analysis

MPPT is achieved by adapting the duty cycle over the essential load at a constant output voltage. Table 1 displays the MPPT precision values and MPP outcomes. The data evidently reveals that the suggested MAO-PPS outperforms standard MAO by obtaining a high precision of 98.39%.

Table 1. Evaluation of Different Algorithms for PV

Performance Metrics	MAO	MAO-PPS
Generated Power (kW)	83.25	85.68
MPP Power (kW)	85.14	87.11
Precision (%)	96.17	98.39

The MAO-PPS surpasses the MAO controller in terms of MPP power by obtaining 87.11 kW whereas the MAO controller obtains the maximum power of 85.14 kW, as seen in Table 1. To further improve the system, the voltage source inverter should include capabilities such as active power filtering as well as power factor change. Nonlinear loads associated to the grid introduce current harmonics, which degrade power quality; this difficulty is minimized by active power filters that compensate for armature currents. With the incorporation of PV into the grid, new voltage regulation challenges emerge.

Table 2 presents a comparative analysis of various algorithms by detailing their performance in terms of efficiency, power loss, and THD. Additionally, the table offers insights into load demand, appropriate charging conditions, and a diminished voltage profile, which details the overall information provided.

Table 2. Assessment of different controller regards to EV

Performance Metrics	MAO	MAO-PPS
THD (%)	3.54	0.29
Efficiency (%)	94.88	99.77
Power loss (KW)	0.124	0.111

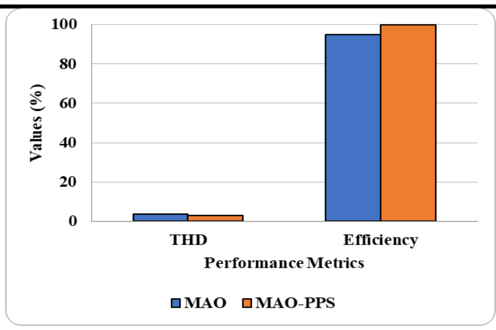

Fig 5. Performances of THD and Power loss

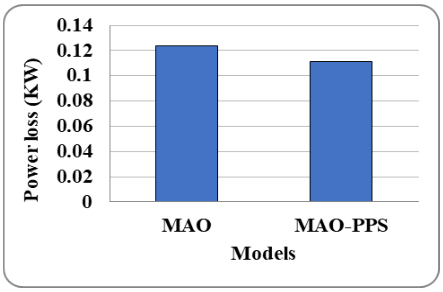

Fig. 6. Performance of Efficiency

The graphical representation of THD and power loss evaluation in given in Fig. 5, while Fig. 6 shows the efficiency computation in MATLAB where the amount of energy delivered by a model to the amount of energy supplied to it. In the modeling phase, raising the dc-link voltage above the input is regarded as irrelevant. The recommended charger setup assures continuous efficiency in the second phase while also delivering an impressively wide output voltage range. All constrainenrgts in this situation have already been discussed in the appropriate section. Fig. 7 depicts the nominal current and discharge parameters of the battery.

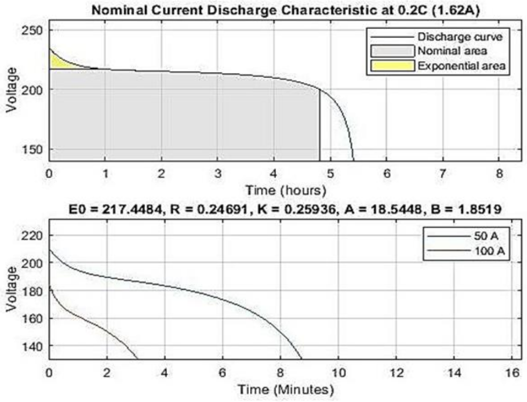

Fig. 7. Characteristics of discharge current

4.2. Comparative Analysis

Here, the comparison evaluation is performed to analyse the enhanced performance of the proposed MAO-PPS method. The existing models such as SSA [16] to determine the optimal combination of control settings and DC–DC Boost Converter [20] to increase the power output of a PV system are considered for the comparison evaluation in terms of THD which is given in table 3.

Table 3. Comparison of conventional models interms of THD

Models	THD (%)
SSA [16]	0.49
DAFB [20]	3.21
Proposed MAO-PPS	0.29

Table 4. Comparison of SSA and proposed MAO-PPS interms of distinct performance

Models	PO (%)	PU (%)	Settling time (T_s (msec))
SSA [16]	0.275	0.0225	20.1
Proposed MAO-PPS	0.214	0.0211	17.12

Table 5. MPPT Comparison evaluation of conventional and proposed models

Models	$P_{int\,peak}$ (kw)	$P_{extractd}$(kw)	$V_{dc\,peak}$ (V)	V_{dc} (V)
$\beta - MPPT$ [20]	95.3	94.5	700	500
Proposed MAO-PPS	97.8	97.5	850	750

From the tables (3-5) it clearly demonstrates that the THD of the recommended method is less (0.29%) and high efficiency (99.77%) $P_{int\,peak}$ (97.8), $P_{extractd}$ (97.5), $V_{dc\,peak}$(850) and V_{dc}(750) with minimum settling time (17.12), undershoot (0.0211), overshoot (0.214), when compared to other conventional models. The integrated device maintains a consistent recharging aspect even though different integrated units have different motor impedance settings when using the recommended control approach.

5. Conclusion

A modern V2G organization is precisely constructed in this research work by flawlessly interfacing with EV motors to uncover unparalleled possibilities. Beyond transportation, the mutual interaction between EVs and the grid provides vital auxiliary services such as power leverage, reactive power support, and excellent frequency and voltage management. This interaction not only improves efficiency but also reduces costs. Therefore, this research introduces a hybrid MAO-PPS technique to optimize the power stability between the components and to adapt the system whenever there is a change occurs. MAO can quickly converge on the best pilot pattern selection technique by offering a set of well-designed pilot patterns that represent different controller switching patterns. Through utilizing the DOA, the reliability of the MAO increases in its convergence towards the optimal solution. So, the algorithm's each Dingo agents move within a hypercube in the search space around the best possible solution thus helps to balance grids and control the frequency. The simulation results shows that the the THD of the recommended method is less (0.29%) and high efficiency (99.77%), $P_{int\,peak}$ (97.8), $P_{extractd}$ (97.5), $V_{dc\,peak}$(850) and V_{dc}(750) with minimum settling time (17.12), undershoot (0.0211), overshoot (0.214), when compared to other conventional models. In future, the research aims to broaden its scope by conducting a thorough examination of the PV-Grid-EV nexus using varied hybrid approaches to improve overall performance indicators.

Author contributions

Seetha Ramanjaneyulu Korada: Conceptualization, Methodology, Software, Field study **Rajamony Brinda:** Data curation, Writing-Original draft preparation, Software, Validation., Field study **Irissappane Dhanusu Soubache:** Visualization, Investigation, Writing-Reviewing and Editing.

Conflicts of interest

The authors declare no conflicts of interest.

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