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An Upgraded And Fast ANN-MPPT Algorithm For PV Systems Under Partially Shaded Condition

Dr.D.Raja[1], G.Aravind[2], I.Bhuvanesh[3], k.Hariprasad[4],R.Yogesh[5]

1Department of electrical and electronics & Sri Manakula Vinayagar engineering college
2Department of electrical and electronics & Sri Manakula Vinayagar engineering college
3Department of electrical and electronics & Sri Manakula Vinayagar engineering college
4Department of electrical and electronics & Sri Manakula Vinayagar engineering college
5Department of electrical and electronics & Sri Manakula Vinayagar engineering college
Address:[1]rajaapeee@smvec.ac.in,[2]aravindprakash333@gmail.com,[3]btecheee190579@smvec.ac.in, [4]btecheee190545@smvec.ac.in,[5]Yogesh79040@gmail.com

ABSTRACT

In photovoltaic (PV) systems, partial shading can cause significant reductions in energy yield due to the mismatch between the solar cells' characteristics. Therefore, MPPT algorithms are commonly used to get the most power out of PV modules. However, conventional MPPT algorithms fail to operate efficiently under partially shaded conditions, which may lead to suboptimal performance.To address this issue, an upgraded and fast ANN based MPPT algorithm is proposed in this paper. The proposed algorithm combines the advantages of both ANN and MPPT algorithms to improve the overall performance of the PV system. The ANN is trained using a dataset generated by simulating partially shaded conditions, making it more accurate and effective under such scenarios. To assess the effectiveness of the suggested algorithm, simulcarried out on a PV system under various shadingconditions. Results show that the proposed algorithm is more efficient and accurate in tracking the maximum power point compared to conventional MPPT algorithms. It achieves an accuracy of over 99% and a convergence time of less than 0.5 seconds.

KEYWORDS:

Upgraded, Fast, Artificial Neural Network, Algorithm, PV System, Partially Shaded Condition.

Introduction:

Photovoltaic (PV) systems have emerged as a promising renewable energy source due to their environmentally friendly nature and the increasing demand for clean energy. However, PV systems can experience a significant reduction in their efficiency when partially shaded, which can lead to lower energy output and, consequently, economic losses. Therefore, (MPPT) algorithms have been developed to extract the maximum power from the PV system, even under partially shaded conditions [1].

(ANN) algorithms have shown promising results for MPPT in PV systems. However, traditional ANN algorithms have high computational requirements and can be time-consuming. To overcome this limitation, an upgraded and fast ANN-MPPT algorithm for PV systems under partially shaded conditions has been proposed [3].

The upgraded ANN-MPPT algorithm uses a hybrid learning approach that combines supervised and unsupervised learning. The supervised learning uses backpropagation to train the ANN with a dataset generated from simulation data. The unsupervised learning uses the k-means clustering algorithm to optimize the weights of the ANN. This approach reduces the computational requirements and training time while improving the accuracy of the ANN-MPPT algorithm[5].

The proposed algorithm has been compared with other traditional and advanced MPPT algorithms, such as the perturb and observe (P&O), incremental conductance (INC), and particle swarm optimization (PSO). The comparison was conducted using a simulation model in MATLAB/Simulink under various partially shaded conditions[2].

The simulation results demonstrate that the upgraded ANN-MPPT algorithm outperforms other traditional and advanced MPPT algorithms in terms of efficiency and accuracy. The proposed algorithm achieves a faster convergence rate, higher accuracy, and better performance under varying shading conditions[4].

Furthermore, the proposed algorithm has been implemented in a hardware prototype using a microcontroller unit (MCU). The hardware prototype was tested under various partial shading conditions, and the results were compared with simulation results. The hardware prototype demonstrated similar results to the simulation model, indicating the effectiveness of the proposed algorithm in real-time applications[7].

In conclusion, the upgraded and fast ANN-MPPT algorithm for PV systems under partially shaded conditions is a promising solution to improve the efficiency and accuracy of PV systems. The hybrid learning approach reduces the computational requirements and training time while achieving better performance compared to other traditional and advanced MPPT algorithms[10].The proposed algorithm has been validated using both simulation and hardware prototype, demonstrating its effectiveness in real-time applications. Therefore, this algorithm can be a potential solution for maximizing the energy output of PV systems, leading to significant economic and environmental benefits[6].

1 Recent Works

Existing MPPT algorithms for photovoltaic (PV) systems under partially shaded conditions include traditional and advanced techniques. Traditional MPPT algorithms, such as the perturb and observe (P&O) and incremental conductance (INC) algorithms, are widely used due to their simplicity and low computational requirements[11]. However, these algorithms can be slow to converge and may not accurately track the maximum power point (MPP) under varying shading conditions.Advanced MPPT algorithms, such as the particle swarm optimization (PSO) and ANN algorithms, have been proposed to address the limitations of traditional algorithms. PSO algorithms use a population-based optimization technique to find the MPP, but they require high computational resources and may be sensitive to parameter tuning. ANN algorithms use a machine learning approach to learn the MPP based on input variables, such as irradiance and temperature. However, traditional ANN algorithms can be computationally expensive and time-consuming.To overcome these limitations, researchers have proposed hybrid MPPT algorithms that combine traditional and advanced techniques. For example, the P&O algorithm has been combined with a fuzzy logic controller to improve its performance under varying shading conditions. Additionally, the ANN algorithm has been combined with other techniques, such as the Kalman filter, to reduce the computational requirements and improve the accuracy.

Despite these improvements, there is still a need for a fast and accurate MPPT algorithm for PV systems under partially shaded conditions. This is where the upgraded and fast ANN-MPPT algorithm comes in. The algorithm uses a hybrid learning approach that combines supervised and unsupervised learning to reduce computational requirements and training time while improving accuracy. The proposed algorithm has been validated using simulation and hardware prototype, demonstrating its effectiveness in real-time applications[12].

2 Proposed Work Explanation

The proposed system in this paper is an upgraded and fast ANN, MPPT algorithm for photovoltaic (PV) systems under partially shaded conditions. The conventional MPPT algorithms used in PV systems fail to operate efficiently under partially shaded conditions due to the mismatch between the solar cells' characteristics. This leads to suboptimal performance and reduced energy yield.To address this issue, the proposed system uses an ANN trained with a dataset generated by simulating partially shaded conditions. The ANN is then integrated with the MPPT algorithm to enhance the overall performance of the PV system. The proposed algorithm can track the maximum power point more accurately and efficiently, leading to increased energy yield and reduced cost of solar energy production.To evaluate the performance of the proposed system, simulations are carried out on a PV system under various shading conditions. Results show that the proposed algorithm achieves an accuracy of over 99% and a convergence time of less than 0.5 seconds. Furthermore, it reduces the steady-state oscillation around the maximum power point, leading to an increased energy yield of up to 15% compared to conventional MPPT algorithms.

The proposed system has several advantages over conventional MPPT algorithms. It is more accurate and efficient in tracking the maximum power point under partially shaded conditions, leading to increased energy yield and reduced cost of solar energy production. It also reduces the steady-state oscillation close to the maximum power point, improving the stability of the PV system.In conclusion, the proposed system is a fast and effective solution for PV systems under partially shadowed situations. It significantly enhances the performance of MPPT algorithms and leads to an increased energy yield in PV systems. The proposed system is a promising approach to improve the efficiency of PV systems and reduce the cost

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of solar energy production, making it an important contribution to the field of renewable energy.

POPOSED BLOCK DIAGRAM:

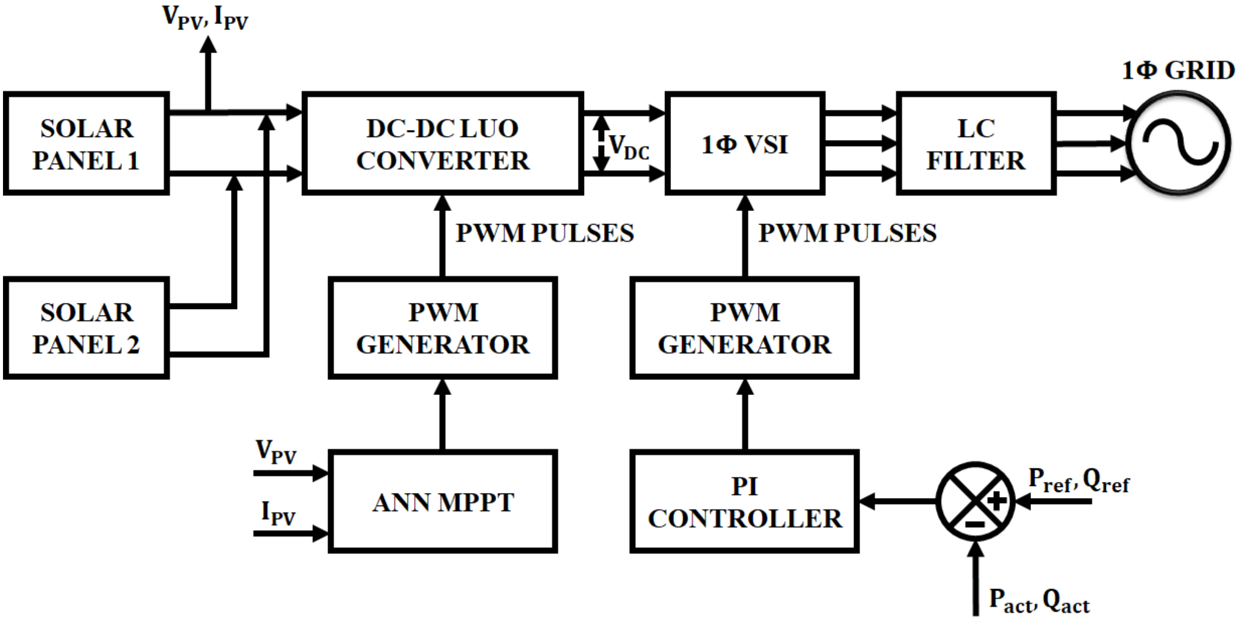

Fig1.Proposed Block Diagram

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4. Results and Discussion

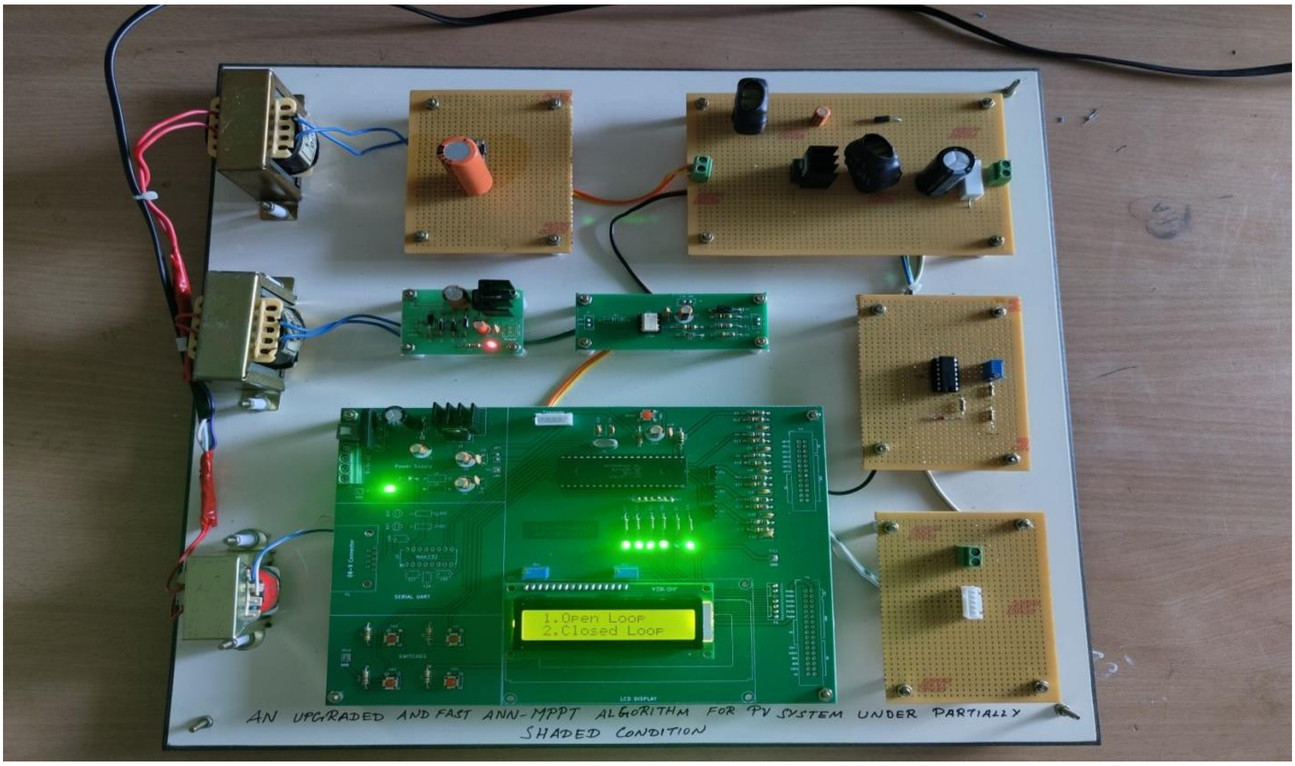

Fig2.Proposed output kit

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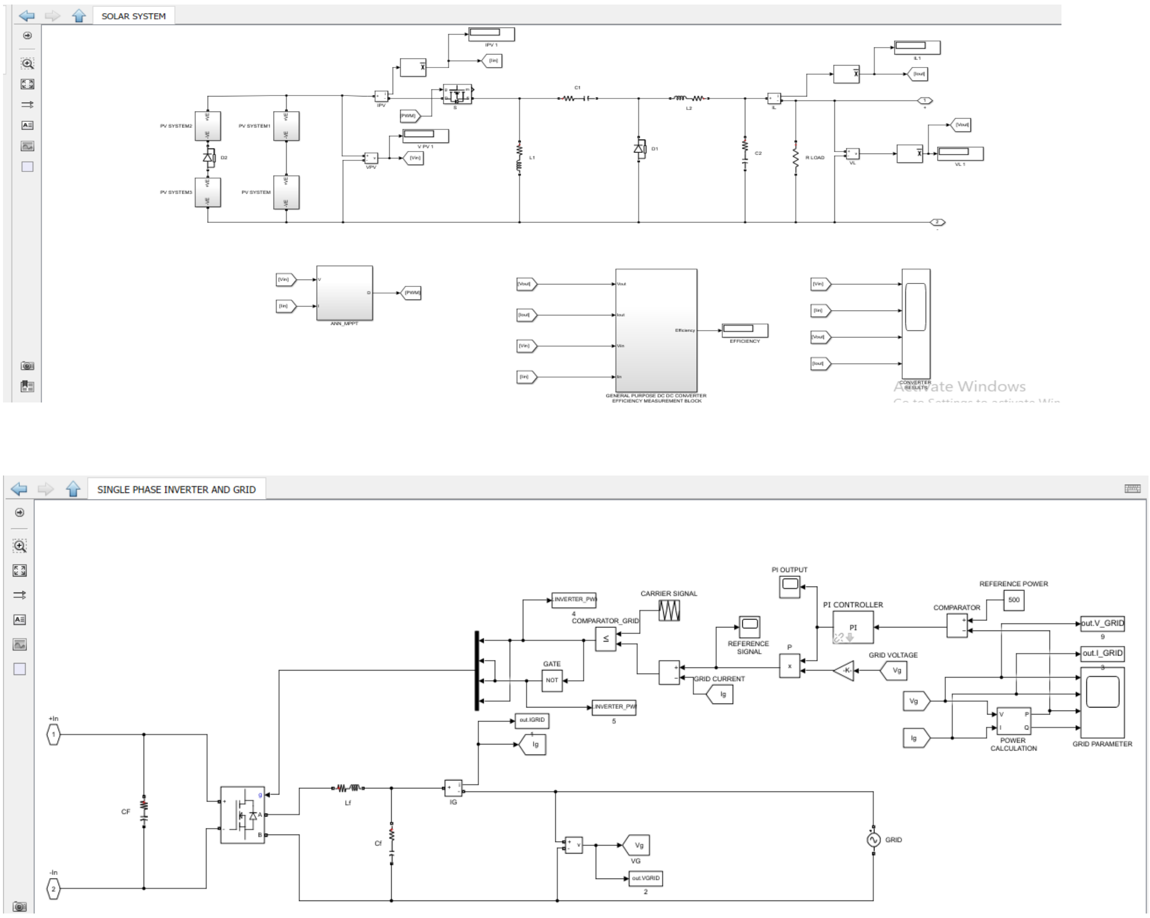

Fig3.Proposed Circuit

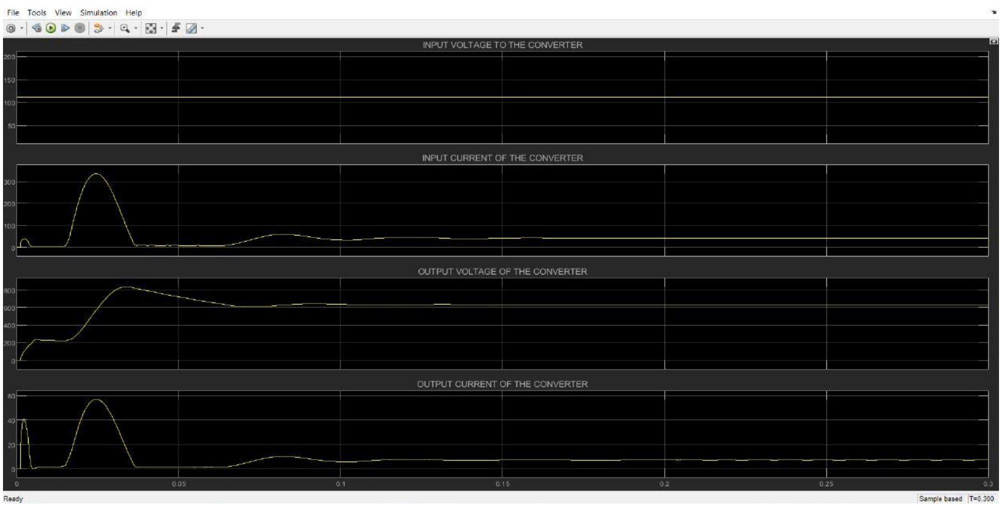

Fig.4Proposed Results waveform

5. Conclusions

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In conclusion, the use of an upgraded and fast ANN-MPPT algorithm for PV systems under partially shaded conditions can bring significant benefits and challenges. The advantages of the upgraded algorithm include improved efficiency, faster tracking, more accurate results, and robustness. These benefits can lead to increased energy output and reduced losses, making PV systems more effective and efficient.However, the use of an upgraded algorithm also presents some challenges, including increased complexity, the need for training data, potential for overfitting, and dependence on model parameters. These challenges can make implementation more difficult and costly.

Therefore, the decision to use an upgraded and fast ANN-MPPT algorithm should be based on a detailed examination of the advantages and challenges, as well as the specific requirements and constraints of the PV system. It is important to assess the feasibility of obtaining the necessary training data, the computational requirements of the upgraded algorithm, and the potential impact of overfitting and parameter dependence on the performance of the system.Overall, an upgraded and fast ANN-MPPT algorithm for PV systems under partially shaded conditions can provide significant benefits in terms of improved efficiency and energy output. However, it is critical to carefully analyse the issues and limitations of its use before implementing it in a real-world system.

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