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IMPROVING THE EFFICIENCY OF SOLAR PANELS WITH ARTIFICIAL INTELLIGENCE

Yusupov Yodgorjon Akbarovich,

Fergana branch of the Tashkent University of Information Technologies named after Muhammad al-Khorazmi, Fergana, Uzbekistan
E-mail: edgoru88@gmail.com

Nabieva Maysarakhon Shukhratjon kizi,

Fergana branch of the Tashkent University of Information Technologies named after Muhammad al-Khorazmi, Fergana, Uzbekistan
E-mail: nabiyevamaysaraxon@gmail.com

Abstract. *This paper explores the importance of artificial intelligence (AI) technologies in improving the efficiency of solar panels. Today, solar energy plays an important role in ensuring climate change and energy security as an environmentally friendly and sustainable energy source. With the help of artificial intelligence, the possibilities of solar panel optimization, maintenance, energy production planning based on weather forecast and remote monitoring are analyzed.*

Keywords: *solar panels, artificial intelligence, energy efficiency, remote monitoring, automation..*

ПОВЫШЕНИЕ ЭФФЕКТИВНОСТИ СОЛНЕЧНЫХ ПАНЕЛЕЙ С ИСКУССТВЕННЫМ ИНТЕЛЛЕКТОМ

Юсупов Ёдгоржон Акбарович,

Ферганский филиал Ташкентского университета информационных технологий имени Мухаммада аль-Хоразми, Фергана, Узбекистан
E-mail: edgoru88@gmail.com

Набиева Майсарахон Шухратжон кизи,

Ферганский филиал Ташкентского университета информационных технологий имени Мухаммада аль-Хоразми, Фергана, Узбекистан
E-mail: nabiyevamaysaraxon@gmail.com

Аннотация. *В данной статье рассматривается важность технологий искусственного интеллекта (ИИ) в повышении эффективности солнечных панелей. Сегодня солнечная энергия играет важную роль в обеспечении климатической и энергетической безопасности как экологически чистый и устойчивый источник энергии. С помощью искусственного интеллекта анализируются возможности оптимизации солнечных панелей, обслуживания, планирования производства энергии на основе прогноза погоды и удаленного мониторинга.*

Ключевые слова: *солнечные панели, искусственный интеллект, энергоэффективность, удаленный мониторинг, автоматизация.*

Introduction. Solar energy is an environmentally friendly and sustainable energy source that plays an important role in solving climate change problems and energy security issues. In recent years, solar energy technologies have developed rapidly, and artificial intelligence (AI) is being used to improve the efficiency of solar panels. Artificial intelligence-based technologies provide opportunities for real-time control of energy production processes, technical maintenance, and remote monitoring of solar panels. Smart solar panel technologies are helping to increase efficiency while also reducing operating costs.

The objective of the article is to analyze the role and achievements of artificial intelligence technologies in increasing the efficiency of solar panels, and to present the results of practical research.

Literature analysis and methodology. This section analyzes research and projects aimed at increasing the efficiency of solar panels using artificial intelligence technologies. The relationship between solar energy and artificial intelligence is important, the research conducted in this area is devided into the following main directions:

Solar panels placement and optimization. rtificial intelligence algorithms can help ensure the optimal placement of solar panels. For example, neural networks can be used to select the angle and location of solar panels to maximize their solar gain. [1].

Algorythsms and models: Genetic algorithms, gradient descent, and other optimization methods are used to place solar panels. Studies have shown that these methods can increase the efficiency of solar panels by 15-30%.

Optimization based on weather forecast: Automating the operation of panels in accordance with weather forecasts stabilizes energy production. Bunda Machine Learning (ML) models can be used to predict solar radiation levels. For example, LSTM (Long Short-Term Memory) models and Convolutional Neural Networks can be used to predict solar energy production with high accuracy [2].

Statistical analysis and modelling: Various statistical methods, including time series forecasting and regression analysis, are widely used in solar energy forecasting. According to reports, optimization based on weather forecasts can increase energy production by up to 20%. [3].

Maintenance and monitoring. Maintenance systems are essential to maintaining the efficiency of solar panels. This involves analyzing the

performance of the panels through various sensors using artificial intelligence, and detecting failures in advance.

For example, predictive maintenance algorithms can help repair panels before they fail. Such systems have been shown to reduce maintenance costs by 20-30%. [4].

Remote monitoring systems. Solar farms are equipped with monitoring systems using unmanned aerial vehicles, or drones. Drones are used to determine the general condition of the panels, the level of contamination, and other technical conditions.

Drone technologies and artificial intelligence algorithms: Object detection and image recognition algorithms are used for these monitoring processes. These technologies have been found to be 40% more effective than the human factor [5].

Results. The article presents the following results based on the research conducted:

Predictive maintenance. It has been found that the use of artificial intelligence technologies can reduce maintenance costs by up to 25%. For example, based on data collected using sensors, the condition of panels is assessed and the need for services such as replacement of spare parts or cleaning is determined in advance [6].

Optimizing solar panel placement. By automatically positioning and controlling the angle of solar panels, energy generation efficiency can be increased by 20-30%. Algorithms adjust the placement of panels to maximize sunlight throughout the day [7].

Weather forecast-based optimization. Based on weather forecasts developed using AI, solar farms can increase energy production by up to 15-20%. In this way, solar farms adapt to weather conditions and optimize energy production [8].

Remote monitoring efficiency. Remote monitoring systems can increase the efficiency of solar farms and make maintenance processes 40% more efficient and faster [9].

Discussion. The combination of solar energy technologies and artificial intelligence technologies will allow for significant improvements in energy production and maintenance.

These technologies have the potential to reduce carbon footprint and provide cost-effectiveness. Remote monitoring and maintenance systems also help reduce operating costs in the long term.

Conclusion. Artificial intelligence technologies are being used to improve the efficiency of solar panels and reduce operating costs. These technologies will allow for a new phase of solar energy utilization and increase the sustainability of solar farms.

In the future, to further increase the efficiency of solar panels and reduce operating costs, it is necessary to further develop AI technologies, especially research in the areas of weather forecasting and predictive maintenance.

It is possible to create new solutions that serve energy security and environmental sustainability worldwide by developing and implementing these technologies.

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1. Ergashev, O. M., Turgunov, B. X., & Turgunova, N. M. (2023). Microprocessor Control System for Heat Treatment of Reinforced Concrete Products. International journal of inclusive and sustainable education, 2(5), 11-15.
2. Obukhov, V., Qadamova, Z., Sobirov, M., Ergashev, O., & Nabijonov, R. (2024). Methods for using elliptic curves in cryptography. In E3S Web of Conferences (Vol. 508, p. 05009). EDP Sciences.
3. Farxodjon o‘g‘li, N. I. (2024). Bir razryadli 7 ta segmentli indikatorni arduino tizimida tahlil qilish. Miasto Przyszłości, 47, 222-228..
4. Farxodjon o‘g‘li, N. I. (2024). Arduino mikrokontrolleri yordamida harorat datchiklarini tahlil qilish. Miasto Przyszłości, 47, 229-233.
5. Otaqulov, O. X., & Pulatova, G. A. Q. (2021). Sun’iy intellekt va uning insoniyat faoliyatida tutgan o‘rni. Scientific progress, 2(8), 929-935.

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Адрес редакции:
150100, Ферганская област, г. Фергана, улица Солим, дом 23/4, кв. 26

E-mail:
chief_editor@epai.uz

Наш сайт:
https://epai.uz/

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