ABSTRACT

In recent years, the use of solar energy has grown rapidly as an environmentally friendly energy source. However, to manage an efficient energy system, it is crucial to have accurate estimations of solar power production. This study aims to develop a more accurate and efficient solar power estimation method by employing Attention Layer Neural Networks (ALNN) optimized with Particle Swarm Optimization (PSO). Meanwhile, the Internet of Things (IoT) is utilized to collect voltage data directly from solar panels through connected sensors. After the IoT sensors gather the voltage data, the dataset extracted from the file 'GSR_RI_Hourly_2012_2020.xlsx' is processed using ALNN, which focuses on the most relevant information in solar power estimation modeling. To maximize model performance, PSO is applied to determine the optimal neural network parameters, thereby improving prediction accuracy. The results indicate that although IoT is only used to measure voltage and display data directly, the integration of IoT, ALNN, and PSO provides a significant contribution to solar energy monitoring and estimation systems. IoT serves as the data collection component, while ALNN and PSO support data processing and optimization to enhance prediction accuracy. Although the performance difference between the model with PSO and without PSO is relatively small, with an R^2 difference of only -0.001, PSO still offers a slight improvement in estimation efficiency. This approach establishes a stronger foundation for developing smarter and more sustainable solar energy measurement and management systems, although further research with alternative methods may yield more efficient solutions.

***Keywords**: Solar Energy, IoT, ALNN, PSO, Voltage, Solar Energy Monitoring System, Model Optimization, Smart Technology.*