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IoT-based Deep Learning Neural Network (DLNN) algorithm for voltage stability control and monitoring of solar power generation

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A B S T R A C T

Today, Solar Photovoltaic (SPV) energy, an advancing and attractive clean technology with zero carbon emissions, is widely used. It is crucial to pay serious attention to the maintenance and application of Solar Power Generation (SPG) to harness it effectively. The design was more costly, and the automatic monitoring is not precise. The main objective of the work related to designed and built up the Internet of Things (IoT) platform to monitor the SPV Power Plants (SPVPP) to solve the issue. IoT platform designing and Data Analytics (DA) are the two phases of the proposed methodology. For building the IoT device in the IoT platform designing phase, diverse lower-cost sensors with higher end-to-end delivery ratio, higher network lifetime, throughput, residual energy, and better energy consumption are considered. Then, Sigfox communication technology is employed at the Low-Power Wireless Area Network (LPWAN) communication layer for lower-cost communication. Therefore, in the DA phase, the sensor monitored values are evaluated. In the analysis phase, which is the most significant part of the work, the input data are first pre-processed to avoid errors. Next, to monitor the Energy Loss (EL), the fault, and Potential Energy (PE), the solar features are extracted as of the pre-processed data. The significance of utilizing the Transformation Search centered Seagull Optimization (TSSO) algorithm, the significant features are chosen as of the extracted features. Therefore, the computational time of the solar monitoring has been decreased by the Feature Selection (FS). Next, the features are input into the Gaussian Kernelized Deep Learning Neural Network (GKDLNN) algorithm, which predicts the faults, PE, and EL. In the experimental evaluation, solar generation is assessed based on Wind Speed (WS), temperature, time, and Global Solar Radiation (GSR). The systems are satisfactory and produce more power during the time interval from 12:00 PM to 1:00 PM. The performance of the proposed method is evaluated based on performance metrics and compared with existing research techniques. When compared to these techniques, the proposed framework achieves superior results with improved precision, accuracy, F-measure, and recall.

A R T I C L E I N F O

Keywords:
Solar photovoltaic (SPV);
Internet of things (IoT);
Data analytics;
Sigfox communication technology;
Low-power wireless area network (LPWAN);
Energy loss;
Machine learning;
Transformation search centered seagull optimization algorithm (TSSO);
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