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AI-Based Load Forecasting for Smart EV Charging Stations Using Wireless IoT Sensors

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Abstract: *The proliferation of electric vehicles (EVs) has necessitated the development of intelligent and scalable charging infrastructure to ensure grid stability and operational efficiency. Smart EV charging stations (SEVCS), empowered by wireless Internet of Things (IoT) sensors and artificial intelligence (AI), represent a transformative solution to address these challenges. This paper presents an AI-based framework for short-term load forecasting in SEVCS using a hybrid Convolutional Neural Network–Long Short-Term Memory (CNN-LSTM) model. The framework integrates real-time data collected from a distributed network of wireless IoT sensors, including energy meters, environmental monitors, and EV detectors. Data pre-processing and edge-cloud architecture are employed to facilitate timely and accurate forecasting. A pilot study conducted at an urban SEVCS site demonstrates that the proposed CNN-LSTM model outperforms traditional forecasting methods such as ARIMA, SVM, and standalone LSTM in terms of RMSE, MAE, and R^2 score. The findings underscore the efficacy of combining AI with IoT technologies to enable adaptive energy management and predictive control in future smart mobility ecosystems.*

Keywords: Smart EV Charging Stations; Load Forecasting; Artificial Intelligence; Wireless IoT Sensors; CNN-LSTM; Smart Grid; Electric Vehicles

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