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DESIGN OF AN AI-POWERED PREDICTIVE MAINTENANCE SYSTEM FOR INDUSTRIAL IOT NETWORKS

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Abstract

The Industrial Revolution 4.0 presents new challenges in industrial asset management, particularly regarding equipment maintenance. Traditional maintenance approaches, both reactive and preventive, have proven to be less efficient because they cause downtime and waste costs. Therefore, predictive maintenance emerges as a promising solution through the utilization of the Internet of Things (IoT) for real-time data collection and Artificial Intelligence (AI) for failure pattern analysis. This article presents a literature review on the design of an AI-based predictive maintenance system integrated with an industrial IoT network. The study was conducted by searching literature from reputable databases such as IEEE Xplore, ScienceDirect, ACM, and Springer, using the keywords "Predictive Maintenance", "AI", "IoT", "Industrial IoT", and "Machine Learning". The review results show that classic machine learning algorithms (e.g., Random Forest, SVM, and Decision Tree) are capable of making predictions with structured data, while deep learning approaches (LSTM, CNN, Autoencoder) are superior in processing complex and time-series data. Nevertheless, challenges still exist in the aspects of IoT device interoperability, data security, limitations of failure datasets, and the need for energy efficiency for real-time processing. This literature review contributes to summarizing the trends, advantages, and limitations of AI methods used in industrial IoT predictive maintenance. Future development potential includes the application of Edge AI for efficient computing, Federated Learning for data privacy, and Digital Twin integration to improve the accuracy of predictive simulations. By addressing these challenges, AI-powered predictive maintenance systems are expected to become a key pillar in