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ADVANCING PHARMACEUTICAL OPERATIONS THROUGH AI-ENABLED IT SYSTEMS: A TECHNICAL ANALYSIS OF PREDICTIVE MAINTENANCE AND CYBERSECURITY

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Abstract

This technical article examines the transformative impact of artificial intelligence on pharmaceutical manufacturing operations, focusing on predictive maintenance and cybersecurity frameworks. The article investigates how AI-driven systems are revolutionizing equipment maintenance, threat detection, and regulatory compliance in GxP environments. Through comprehensive analysis of implementations across multiple pharmaceutical facilities, the article demonstrates significant improvements in operational efficiency, system reliability, and security protocols. The article encompasses three key areas: AI-driven predictive maintenance systems, enhanced cybersecurity frameworks, and operational integration impacts. The article reveals how edge computing and hybrid cloud architectures are shaping the future of pharmaceutical manufacturing, while maintaining strict compliance with regulatory requirements and ensuring data integrity.

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Artificial Intelligence, Pharmaceutical Manufacturing, Predictive Maintenance, Cybersecurity, GxP Compliance.

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