IJARSCT

International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

ISSN: 2581-9429

Volume 6, Issue 4, January 2026

Impact Factor: 7.67

Application of Machine Learning for Predictive Maintenance in AI-Driven Robotic Manufacturing Systems

Virender Kumar[1] and Dr. Basant Lal[2]

[1]Research Scholar, Department of Mechanical Engineering

[2]Research Guide, Department of Mechanical Engineering

NIILM University, Kaithal, Haryana

Abstract: *The integration of Machine Learning into predictive maintenance has transformed modern robotic manufacturing systems by enabling intelligent fault detection, real-time monitoring, and optimized asset utilization. In AI-driven robotic environments, unplanned downtime can cause significant economic losses, reduced productivity, and safety hazards. This review paper explores the application of ML techniques including supervised, unsupervised, and deep learning models in predictive maintenance for robotic manufacturing systems. It discusses sensor integration, data preprocessing, model selection, system architecture, benefits, challenges, and future research directions. The review also provides comparative tables and graphical illustrations of algorithm performance, maintenance strategies, and system workflow. The findings highlight that ML-based predictive maintenance significantly improves reliability, reduces downtime, and enhances operational efficiency in Industry 4.0 environments.*

Keywords*:* Predictive Maintenance, Industry 4.0, Fault Diagnosis