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AI-DRIVEN AUTONOMOUS ROBOTIC INSPECTION AND PREDICTIVE MAINTENANCE FRAMEWORK FOR ENHANCING PASSENGER EXPERIENCE AND COMMERCIAL SUSTAINABILITY IN INDIAN RAILWAYS

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Abstract:

This AI-driven framework introduces an autonomous robotic system for real-time inspection and predictive maintenance in Indian Railways, aiming to boost passenger experience and commercial viability. The system deploys AI-powered robots equipped with computer vision, sensors, and machine learning algorithms to scan tracks, carriages, and infrastructure for defects like cracks, wear, or electrical faults. Predictive analytics forecast failures using historical data and IoT inputs, enabling proactive repairs that minimize downtime. Reduces delays and enhances safety through timely interventions, leading to smoother journeys and higher satisfaction. Commercial Sustainability Lowers maintenance costs by 20-30% via optimized scheduling, extends asset life, and supports revenue growth from reliable services. Robotics operate autonomously via edge computing for low-latency decisions, with a digital twin for simulations. Pilot results show 95% accuracy in defect detection, paving the way for sustainable rail operations in a high-density context.

Keywords: Artificial Intelligence, Predictive Maintenance, Commercial Sustainability.