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Digital Revolution in Maintenance: Automated Solutions for Underground Mining

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Abstract

Digitalization and automation are transforming maintenance processes in underground mining. This contribution explores how technologies like IoT, AI, and autonomous systems optimize maintenance, improve safety, and enhance efficiency. A key focus is the use of digital twins to monitor equipment in real-time, enabling predictive maintenance and condition-based repairs tailored to actual needs. This approach reduces downtime, extends machine life, and ensures resource-efficient operations.

The deployment of autonomous robots and drones for inspection tasks is another highlight. Equipped with AI-driven algorithms, these systems can assess hard-to-reach areas and identify issues like wear and tear or structural damage, minimizing risks to human workers. The collected data feeds into a centralized digital infrastructure, supporting data-driven decision-making.

Additionally, a main discussion point is how to manage the organizational shift to digital maintenance, emphasizing the need for new skills in data analysis and a culture of continuous improvement. It concludes by addressing how these digital strategies contribute to sustainability and cost optimization by reducing machine failures and resource consumption.

Keywords: Automation; Data Analysis; Digital Twin; Predictive Maintenance; Resource Efficiency