Spatial Digital Twin of Mining Operations

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# ABSTRACT

The Spatial Digital Twin (SDT) signifies a major leap forward in the visualisation and management of mining operations. This cutting-edge technology integrates sensor feeds from Internet of Things (IoT) devices, performs analytics on these data streams and overlays these operational data insights on an immersive three-dimensional (3D) visualisation, creating a virtual model of the mine site that replicates real-world mining assets and operations.

Some of the use cases include utilising predictive models to forecast potential issues and optimise maintenance schedules, production schedules and material movements, thereby enhancing operational reliability, increasing productivity and minimising downtime. For example, the SDT can simulate the entire mine site layout, including haul roads, stockpiles and infrastructure, allowing mine planners to anticipate equipment movements and logistics challenges.

Measurement tools within the SDT enable calculations of distance, elevation and volume, enabling cut-and-fill assessments, access planning, and other works scoping. 3D visualisation tools allow engineers to detect potential geotechnical hazards in open-pit mines by analysing slope angles and stress factors in rock formations. These tools assist in monitoring and managing the environmental impact of mining activities, ensuring compliance with regulations and sustainability objectives.

The integration of geospatial and video analytics further enhances site security and operational compliance, mitigating the risk of accidents and ensuring prompt responses to incidents. For instance, AI-powered video analytics can import, post-process and analyse automonous drone footage collected hourly along pre-determined flight paths, monitoring the mine progression, identifying deviations and performing production reconcilations.

The Spatial Digital Twin is a transformative tool that enhances the decision-making process for mine planners and engineers by providing a unified, real-time view of mining operations. Its advanced analytics capabilities support enhanced decision-making and operational efficiency, rendering it a valuable asset in the digital transformation of the mining industry.