Global Navigation Satellite System(GNSS) based Machine Guidance System for Improving Surface Mining Efficiency

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SUMMARY

The operational efficiency of surface drill rigs is critical to overall productivity in mining operations. However, this efficiency is increasingly compromised by a growing shortage of skilled operators and surveyors. To address this challenge, this paper presents the development of a high-precision machine guidance system for mining drill rigs. The system integrates a Global Navigation Satellite System (GNSS) with an Inertial Measurement Unit (IMU) and a laser sensor, utilizing a Digital Terrain Model (DTM) for spatial reference. It provides real-time positioning of the drill bit relative to design specifications, presenting this information to the operator through an intuitive, color-rendered visualization interface for trajectory tracking and quality assessment. Furthermore, the system enables remote monitoring via wireless connectivity, allowing simultaneous oversight from multiple locations. This capability supports real-time data transmission, informed decision-making, and swift response to operational issues, thereby significantly reducing downtime. The implementation of this system demonstrates a substantial improvement in drilling accuracy, operational safety, and overall productivity.
