An Autonomous IIoT-based Monitoring Systems for Intelligent Rock Bolts in Underground Mines

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ABSTRACT (USE 'HEADING 1' STYLE)

This research explores the development potential for utilization of intelligent rock bolts in order to progress towards an autonomous monitoring system in underground mining operations. What that means is we will present the ways and possibilities of how and what for these intelligent rock bolts can be used for. We will discuss the technical background, i.e. the ingredients (sensors) necessary for its realisation. At the same time, this paper critically assesses the systems' limits and the necessary technological improvements for successful implementation into mining, and how these systems could improve efficiency and safety. The primary objectives of this research include implementing intelligent rock bolts as a real-time monitoring system for data acquisition, and assessing their potential for geotechnical evaluation. Critical evaluation of both positive and negative aspects is used to discover the limitations and challenges linked to these systems, e.g. resolution and power constraints, and data analysis complexities. Moreover, the paper defines the technical requirements for the successful deployment of intelligent rock bolts in underground mines. The recommendations put forth serve as a guide for future research and development, outlining areas for further improvement, innovation and in the end deployment. By exploring the potential of autonomous monitoring systems using intelligent rock bolts, this research contributes to the mining industry's ongoing pursuit of becoming safer and more efficient by introducing advanced technology. This research paper contributes to the growing field of IoT in mining with special emphasis on intelligent rock bolt applications in mining by focusing on autonomous monitoring systems. This raises the potential to revolutionize safety and efficiency in underground mining operations. Additionally, it addresses the critical evaluation of limitations and requirements, which is essential for the successful adoption of such technology.