Roof Bolting Module Automation for Enhancing Miner Safety

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ABSTRACT

Roof bolter operators are exposed to hazardous conditions due to their proximity to the unsupported roof, loose bolts and heavy spinning mass. Prolonged exposure to the risk inevitably leads to accidents and injuries. This study focuses on the development of a robotic assembly capable of carrying out the entire sequence of roof bolting operations in a full or partial autonomous sensor-driven rock bolting operations to achieve a high-impact health and safety intervention for equipment operators. The automation of a complete cycle of drill steel positioning, drilling, bolt orientation and placement, resin placement, and bolt securing is discussed using an anthropogenic robotic arm. A human-computer interface is developed to enable interaction of the operators with the machines. Collision detection techniques will have to be implemented to minimize the impact after an unexpected collision has occurred. A robust failure-detection protocol is developed to continuously check the vital parameters of robot operations. This unique approach to automation of small materials handling is described with lessons learned.