Automation Considerations for Underground Shuttle Car Haulage

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As the currently economically viable resources continue to be exploited, the mining industry must plan for deeper orebodies and more challenging mining environments. As mining operators and equipment manufacturers prepare for the future, mining technology improves and embraces new advancements in robotics, autonomous vehicles, smart mining systems and other high-tech options.

Delegating tasks from humans to autonomous vehicles offers a means to optimize three critical factors in every mine: health, safety, and productivity. The relocation of the operators from the active face to a safer, healthier environment, such as that of a control room, can effectively reduce accidents and exposure to unhealthy conditions. The shift to self-driving machines not only improves the health and safety of the workforce, but will also optimize certain aspects of an operation that machines can sometimes negotiate better than humans, such as productivity, efficiency, speed, etc. However, not all machines and operations must be automated to begin using the technology underground.

This paper presents technical considerations for introducing an autonomous shuttle car in room and pillar underground coal mines intended to work with humans operating the other machines. A laboratory-scale shuttle car prototype was built and deployed in the laboratory to navigate a $1/6^{th}$ scale room and pillar operation. Safety protocols, sensor selection, data management, as well as the developed navigation system are demonstrated in the developed workflow.

Key words: Mining, autonomous navigation, shuttle car, room and pillar mining, coal mining