Development of Spilling Judgment System for Dump Truck Loading Using Digital Twin Technology

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ABSTRACT

A lot of positive feedback has been received since the incorporation of digital technology such as autonomous dump trucks into the mining industry. This however does not come without shortfalls such as dump truck overloading. When this phenomenon occurs, dump trucks are more susceptible to a number of calamities which include the reduction of brake performance, poor steering control, noise pollution, excessive exhaust gas emission, and the overall wearing of the body and engine. As a countermeasure, the installation of loading volume marks and covers on the loading bed has been experimented on, which however is not a long-term solution to the problem. Reason for this being the numerous recorded cases in which even the most skilled operators, are said to possess a high-risk potential in miscalculating a load based on load volume marks. To mitigate against this hazard, this paper presents a development of a dump truck load diagnostic system that employs Digital Twin technology. In principle, this system works by capturing numerous photographs from multiple points around the truck during the loading of mined material. From these images, photogrammetry technology is used in constructing a three-dimensional model of the truck plus load. From our results, this system is able to present a three-dimensional model of a loaded truck, thereby empowering the operator in deducing the volume, shape and height of a load, with this data readable from a contour-mapping software. Based on this technology, our proposed method has the potential to allow better load control for dump trucks, thereby increasing the overall productivity of a mine through this system optimization.