Fuel Efficiency Optimisation of HD785-7 Trucks at Open Pit Coal Mine: An Adaptive, Clustering-Based Approach

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# ABSTRACT

Enhancing fuel consumption efficiency is an essential topic for operational sustainability and operational cost in the mining industry. In open pit mining, one of the biggest contributors to fuel consumption is dump trucks (DT). The varying operator driving behaviour and frequently changing mine road environmental conditions, such as road surface and road grade, lead to often unmanageable DT operations and result in sub-optimal fuel consumption. Therefore, the author aims to develop a guidance system that can manage the driving behaviour of DT operators. This study proposes a guidance system that uses a dynamic analytical model with customised algorithms and a near real-time telemetry system to adapt to the changing mine road environment. Using the DBSCAN algorithm combined with other data processing techniques, the model can determine fuel-efficient driving behaviour represented by speed, engine speed, and accelerator position and can adapt to changing mine road environmental conditions without compromising DT productivity. In addition, the model runs every 3 hours to increase the model's flexibility to changes in the mine road environment. In order to evaluate the model's performance, we used an A/B testing approach with a control group consisting of DTs with no recommendations from the model and a variation group consisting of DTs with recommendations from the model. The authors evaluate the model using the fuel burn metric (L/bcm.km) which is a parameter consisting of the fuel rate (L/h) and Productivity (bcm/h.km) components. In other words, the fuel burn metric can indicate the efficiency of fuel consumption. From the evaluation results at one open-pit coal mine site, the variation group has a lower fuel burn rate (L/bcm.km) by 6.25% than the control group. This result explains that the model developed by the authors can enhance the fuel consumption efficiency of DT at open pit coal mine sites. This paper details the algorithm specification and model development, deployment of the model, and the closed loop workflow of the model.