Application of Use Case Modelling to achieve Safe, Efficient Mining Equipment Automation

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Abstract:

In-Pit Crushing and Conveying (IPCC) mining systems can operate in fixed, semi-mobile, or fully mobile (FMIPCC) configurations and have been successfully applied globally demonstrating many operational advantages, especially low operating costs.

However, repositioning of the shovel and hopper system consumes about 6% percentage of total system utilization time due to manual operation. This leads to significant productivity reduction and an increase in the required conditions of system application. To improve the system's effective utilization and operation safety, it is desirable to examine the feasibility of automating shovel/hopper repositioning.

At the user performance stage of designing a complex automated relocation system for the IPCC system, use case modelling (UMC) is a fundamental step. Use Case Modelling approach is commonly used to develop complex software can be effectively applied at help define function and performance requirements (FPR) for automation projects involving complex system interactions. In particular, this paper will demonstrate examples of applying UCM to analyze bench excavation strategies for hopper/shovel interactions in an autonomous fully mobile in-pit crushing and conveying system. The paper also introduces the use of Enterprise Architect (EA) program to document all use cases systematically and generating the sequence diagrams, test cases, and activity with action diagrams.