

## Battery Replacement Strategy for Electric AGVs in an Automated Container Terminal

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**Abstract :** Electric automated guided vehicles (AGVs) are becoming popular in many automated container terminals nowadays because they are pollution-free and environmentally friendly vehicles for transporting the containers within the terminal. Since efficient operation of AGVs is critical for the productivity of the container terminal, the replacement of batteries of the AGVs must be conducted in a strategic way to minimize undesirable transportation interruptions. While a too frequent replacement may lead to a loss of terminal productivity by delaying container deliveries, missing the right timing of battery replacement can result in a dead AGV that causes a severer productivity loss due to the extra efforts required to finish post treatment. In this paper, we propose a strategy for battery replacement based on a scoring function of multiple criteria taking into account the current battery level, the distances to different battery stations, and the progress of the terminal job operations. The strategy is optimized using a genetic algorithm with the objectives of minimizing the total time spent for battery replacement as well as maximizing the terminal productivity.

**Keywords :** AGV operation, automated container terminal, battery replacement, electric AGV, strategy optimization

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