MANAGEMENT AND DESIGN OF ROBOTIC SORTING SYSTEMS

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ABSTRACT

Ecommerce fulfilment operations require rapid sorting solutions for parcels in hubs. Autonomous robotic sorting is a new method to sort parcels cheaply, on a very small footprint. Such robotic sorting systems can now be not only in sorting centers, but also in some ecommerce warehouses. We discuss new queueing-network based models that incorporate congestion of the robots. Such models may help to optimally design such systems for cost and performance, as well as to evaluate different operational policies. We evaluate single and multiple-tier solutions, combined with different driving path topologies and different assignment rules of robots to workstations. By We show the models are accurate by comparing them with simulation and then use them to show that, for both layout types, a square layout is close to optimal and the shortest path topologies lead to shorter throughput times with acceptable congestion levels. We also compare the robotic sorting systems with a conventional cross-belt loop sorter for cost. For low to moderate values of the required throughput capacity, robotic sorter systems are best. However, beyond a critical limit, cross-belt sorters are the cheaper solution.

Keywords: Robotic sorting, Automated warehouses, Queueing networks, performance estimation, simulation.