Challenges and Opportunities in Dense Warehousing

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In heavily constrained environments requiring very high density storage, traditional aisle-based warehousing may not provide efficient options. One feasible manifestation of high density storage system is the so-called ‘puzzle-based’ system, in which unit loads are moved through the system via manipulation of empty (escort) locations to retrieve desired items. In this presentation, the author describes the current state-of-the art in the examinations of such systems, and also describes a future research agenda for puzzle-based warehousing systems. Items of discussion will include system configuration alternatives (2-d vs. 3-d, circular vs. rectangular, etc.), system operational design considerations (allowable movement types), system demand characteristics, system management issues (system replenishment, location of fixed infrastructure, trade-offs between density and retrieval time, collision avoidance, etc.), and solution performance measurement methodologies (metrics, limits of analytical solutions, etc.). Dense, puzzle-based warehousing systems show great promise, but many research questions remain before they can be placed into widespread use.