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Data Model and Software Tools for Modeling Picking Operations

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XXV. DATA MODEL AND SOFTWARE TOOLS FOR MODELING PICKING OPERATIONS

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1 Concept

When developing simulation models of picking warehouses, it would be helpful to find a way to generate some random pick lists based on a given warehouse layout/configuration. The academic community appeared to be lacking any usable form of "starter code" to perform this function. The best answer was essentially, "we modeled the pick locations as a graph and the picker/vehicle travel using paths through the graph." The preferred answer would be if the community could provide the data structures, the file read/write code, and any shortest path code based on the data structures that are applied to an order picking model. Unfortunately, it became clear that the code and corresponding data structure specifications were not readily available in any usable format. Yet, the data models and code *should* be fairly standard and widely available. The request was not focused on proprietary picker-routing, order batching, or WMS code.

With no standards or even de facto standards available, this research began to develop the specifications, data structures, and code. This has been an arduous task that has very little relationship to the actual modeling and research that the code would support. Further, this exact same task has likely been performed hundreds of times by researchers over the years as a precursor to their research/testing. Yet there are no standard data models and associated software tools to represent warehouse configurations and operations. Why?

2 Existing Work

There has been much work on the formal description/modeling of warehouse *operations* (e.g. Huang *et al.*, 2007; Smith and Ozden, 2013; and McGinnis *et al.*, 2013). This work has shown some very interesting and useful results, although there still seems to be very little actual code in the public domain. However, the cited work is generally focused at a higher level of abstraction than the work proposed here. The focus here is on developing a "starting point" of paradigms, data structures, and software tools that the community can use. Examples in other domains abound. Consider GIS (geographic information systems), MPS (mathematical programming systems), and STEP (product manufacturing information exchange) to name a few. When someone wishes to do research in the area of geospatial mapping, math programming, or manufacturing process planning, the researcher generally does not start with determining the mundane details of file formats or internal data structures to support algorithms. Instead, these capabilities are readily available through the referenced standards (whether they are formal standards, de facto standards, or just commonly available and widely used and supported formats), allowing the researcher to focus on their domain of interest. Similar formats, data structures, and modeling paradigms are needed to support the research community. The work described in this paper is an initial version of these things.

3 Tools and Living Archive Site

This research describes the concept and gives relatively high-level descriptions of the data model specifications and associated software tools. In addition, the detailed specifications and software tools (source code) are available on the web site (http://warehouselayout.org). This is the primary "archival result" of the work and the site will evolve as the work continues (long after the IMHRC event is completed).

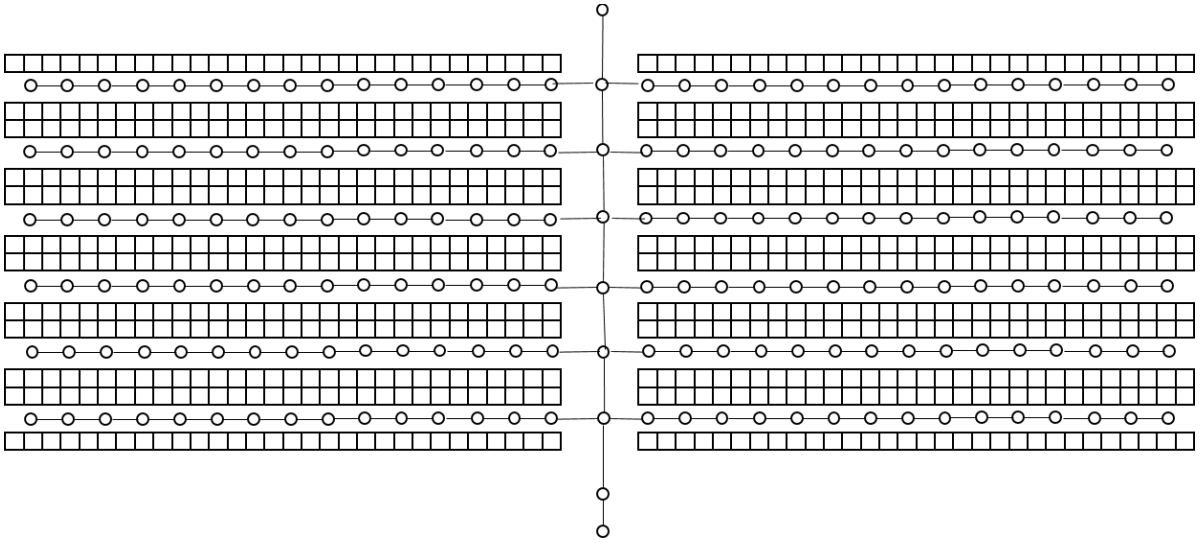

Figure 1. Example 2-by-1 picking layout with picker/vehicle graph overlaid.

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