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Computer simulation and optimization of transport distances of order picking processes

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Abstract

This article deals with optimizing of transport distances in orders picking processes. Article shows solution how to optimize orders picking in warehouse using dynamic simulation. In article basic steps of order picking planning process are described in order to minimize distances traveled by truck or human. The basis of this solution is execution of computer simulation and simulation experiments for faster finding of correct solution, which causes company cost reduction.

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1. Optimization of order picking processes in warehouses with using dynamic simulation

Storage and its correct functioning has significant impact on ensuring higher level of customer service and in protecting utility properties of goods. The method and speed of goods picking is one of the most important areas in warehouses. Rapid development of technologies and market growth causes that companies must deal with questions of satisfying difficult customers with specific and individual requirements and brings more questions about creation of inventories, which complicates designing of warehouses, data collection, picking of orders according to making

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changes and improving logistics in warehouses [1]. Today factories can't wait to decide if changes that they realize will bring necessary results. Each waiting is a loss and every loss entails costs that every manager must eliminate in manufacturing and warehouse [2]. One of many tools that allows managers to make decisions is computer simulation and solutions of digital factory, which has wide application range in companies. In this article it will be described possibility of using computer simulation to optimize transport distances of order picking processes in warehouse by worker on practical example created in software Tecnomatix Plant Simulation 13.

1.1. Simulation model of order picking processes

Monitoring and planning processes of orders picking in warehouses is an important step, because computer simulation can point out when the system begins to fail, when it will be overwhelmed by goods, how to find optimal route for workers during picking orders. This is the way how to reduce number of steps that worker does, thereby shorten time of picking operations. In this case, it is necessary to design experiments and monitor how system will react on changes, for example changing number of workers, reordering sequence of orders or changes in routes. It is also necessary to determine utilization of workers in warehouses, what the core activity of their work is and how much time they spend on the fulfillment of different activities.

Orders picking can be performed in individual orders or in batches of orders. Single batch may contain any number of individual orders, which for some reason is useful to process as a one-time batch. One of the reasons may be requirement for picking several orders at the same time - for a particular carrier or for a network of carriers. According to these reasons, it is advantageous to use computer simulation as a tool to optimize order picking operations.

Computer simulation works with a simulation model created on a computer, it will be time-consuming and very costly to capture and understand all processes that take place in the company or warehouse. Before creation of the model itself, it is necessary to determine only relevant processes and relationships that affect the given system in aspect of the main objective, which must be achieved through simulation experiments. The phase of experiments is usually the most interesting phase of the project, because it begins to bring first results. Statistical analysis is an integral part of each simulation project. It can create debate just about results of experimentation, moreover bringing new ideas and possibilities for improving the simulation model.

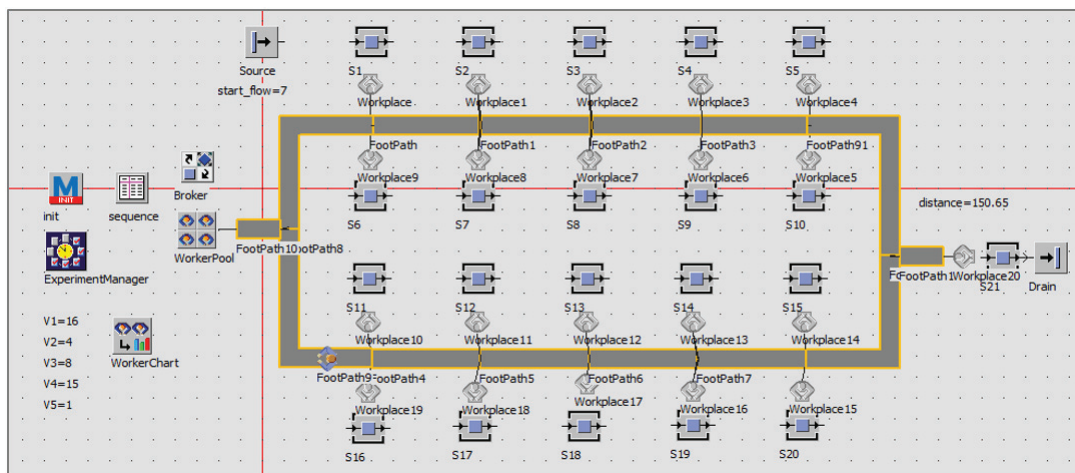


Fig. 1. Model of order picking processes by worker.

In the displayed case in Fig.1, we can consider to find a solution for order picking by a worker during one working shift. The worker's task is to prepare an order, composed of items called V1, V2, V3, V4, V5, which are placed in racks with special places numbered S16, S4, S8, S15, S1. The main goal of the simulation is described so we can make experiments with this model.

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