

Modeling the workstation area of a retail compact item picking system



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Introduction

The Falcon project of the Embedded Systems Institute aims to develop item picking systems for automated distribution centers.

Objectives

- To develop a simulation model of the workstation area of a retail compact item picking system.
- To integrate this model in a larger simulation model of a complete system [1].

System layout

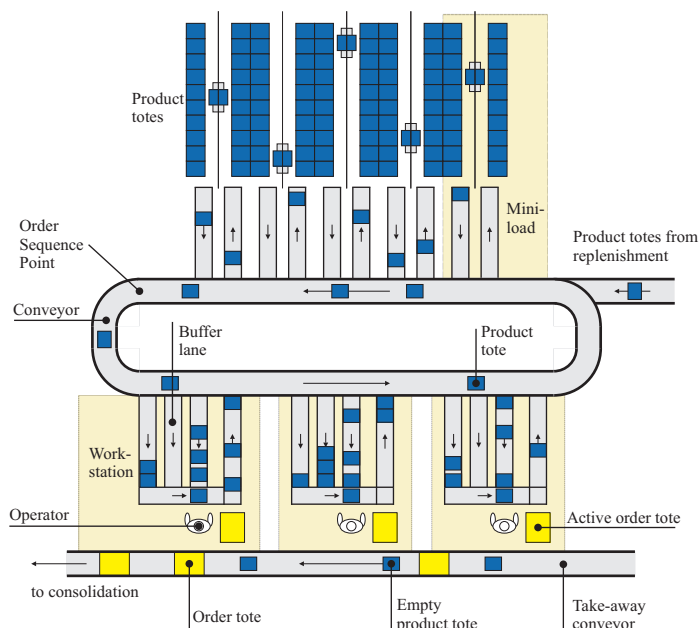


Figure 1: A retail compact picking system

Model architecture

- Modular design, consisting of four layers: order layer, global control layer, local control layer and material layer.
- Autonomous controllers in different control layers of the architecture. Control decisions are based on information exchange between processes.
- Transparent control structure. Control strategies can be altered in a single process, without changing any other process.

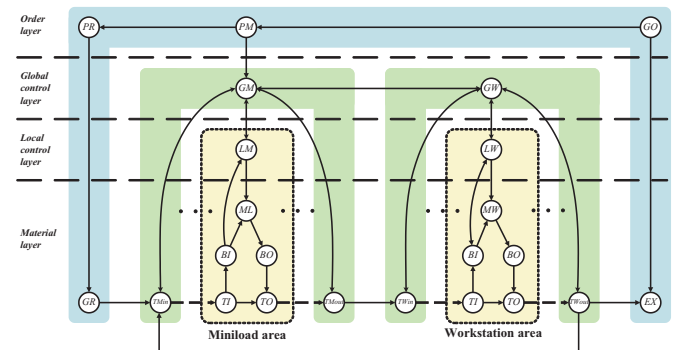


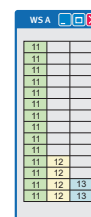
Figure 2: A modular architecture of the compact picking system

Two stacking strategies in a 3-lane workstation buffer

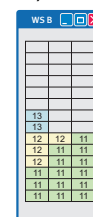
Requirements: All totes of a suborder are processed before the operator can start working on totes of the next suborder. The operator can only reach the bottom tote of a buffer lane.

Strategy A: Stack all totes belonging to a single suborder in a single lane (simple algorithm).

Strategy B: Stack all totes evenly over the lanes (to prevent buffer lane overflow).



Strategy A



Strategy B

WS	Lane 1 [%]	Lane 2 [%]	Lane 3 [%]
Strategy A	10.55	13.64	9.69
Strategy B	0.21	0.15	0.00

Table 1: Percentages of buffer lane overflow for 3 lanes

Conclusion

A detailed simulation model of the workstation area has been developed and integrated in the full simulation model of a retail compact item picking system [1]. The full simulation model has been tested on different control strategies. It can be used as a testing model for aggregate modeling techniques.

References

- [1] R.Andriansyah, R.M.E. Jordan, W.W.H. de Koning, L.F.P. Etman and J.E. Rooda, *A Retail Distribution Center: A Simulation Study*. Technical report, Systems Engineering Group, Eindhoven University of Technology, 2008.