MODELLING OF RFID-BASED SCALABLE LOGISTIC CELL

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There exists now a wide variety of process simulation software [1], which is important to implement a virtual twin of industrial production, logistics and many other processes. The goal of this work is to implement a simple but hopefully powerful model for an universal logistic process, that is scalable and hence useful in a wide variety of logistic applications.

The term "logistic cell" can be derived from cybernetics and namely from the concept of cybernetic systems, which are informational open and functional closed (compare also [2], [3]). For the definition of a *logistic cell* the cybernetic system has to be modified in that way, that it is defined as open for matter and information, because it always has an exchange in matter (material, transport and people flow) and information (external communication) levels. For that these flows are flowing, they have to be powered by energy.

To specify it as a technical model, a functional interaction of the "cell" has to be considered. The main feature of this functional interaction is a *functional autonomy* (operational closed). It means, that the system can work without external input requirements, because it has a sufficient own functionality. On the other hand, this system is determined as matter open, because it can communicate with other cells by means of matter, energy and information exchange. This second property of the here defined logistic cell, can be denoted as *scalability*. Scalability can be also understood as the property of a logistic cell that allows for applying volume and/or size changes in the system.

As an example for the practical application of the logistic cell such a cell with a storage option has been simulated in the simulation software Witness 2014. To demonstrate an industrial logistics identification procedure of incoming goods the technology of Radio-Frequency Identification (RFID) was used as an application example. The simulation can help the companies and parties in the logistics supply chain to identify, understand and prevent a potential inconvenience already in the step of planning and modelling, as the Witness model can be regarded as a virtual twin.

To show the practicability of such a logistic cell, the model is mirrored in a physical prototype in form of an Arduino micro-controller board which is attached to a RFID-Reader, together with a model-warehouse/forklift truck unit. This prototype can be used for the demonstrations as well as for educational purposes.

References:
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