IoTBDS 2020
5th International Conference on Internet of Things, Big Data and Security
Online Streaming | 7 - 9 May, 2020

SCALABLE LOGISTIC CELL RFID WITNESS MODELL

Bernhard Heiden[1], Volodymyr Alieksieiev[1,3] Bianca Tonino-Heiden[3]

[1]*Carinthia University of Applied Sciences, Villach, Austria, b.heiden@fh-kaernten.at;*

[2]*National Technical University "Kharkiv Polytechnic Institute", Kharkiv, Ukraine;*

University of Graz, Graz, Austria

1 INTRODUCTION

This work describes a scalable logistic cell Radio Frequency IDentification (RFID) Witness Model. First, a scalable logistic cell analysis is done which can be applied to the logistics of any size-scale and application. This model is then implemented into Witness and simulated, for different cases. To show practicability, the model is mirrored in a physical Internet of Things (IoT) device in form of an Arduino micro-controller board which is attached to an RFID-Reader, together with a model-warehouse/forklift truck unit.

2 A SCALABLE LOGISTIC CELL

The definition of a scalable logistic cell is based on the theory of systems of N. Luhmann [1], G. Spencer-Brown [2], logistical principles, and Orgiton-theory [3]. According to the theory of systems, the system appears from the separation as a marked state (system) from the unmarked state (external world) [2].

A logistic cell is defined in this work as a system with matter and information exchange with the external world (*unmarked state*) 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, functional interaction of the "cell" has to be considered. The main features of this interaction are ***functional autonomy*** (operationally closed) and **potential interaction with similar cells in their respective matter, energy, and information levels.**

This second property of the here defined logistic cell can be denoted as ***scalability***. Scalability can be understood as the property of a logistic cell that allows for applying volume and/or size changes in the system. Through scalability, the dependence between the borders of the Flow System and Cell System can also be shown (see Figure 1).

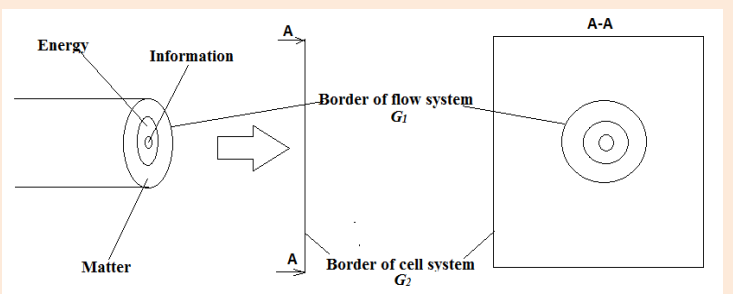

Figure 1: Dependence between borders of the Flow System and Cell System.

3. WITNESS-MODEL

As an example for the practical application of the logistic cell such a cell with a storage option and RFID-system in a simulation software Witness 2014 has been simulated.

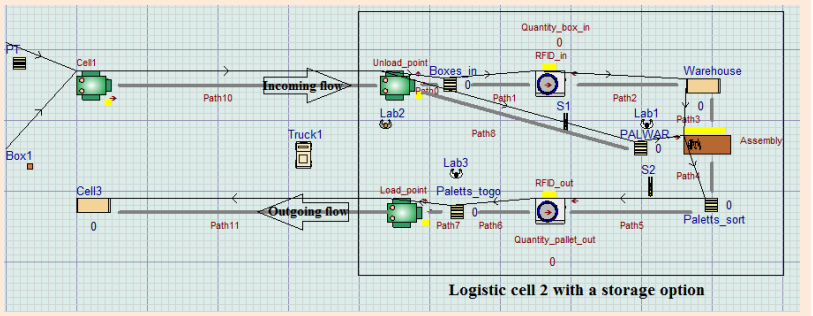

Figure 2: Logistic Cell with a Storage Option in the Witness Model

The model (see Figure 2) consists of the considered logistic cell with a storage option (cell 2) and schematically depicts cell 1 and cell 2, which play the role of e.g. the supplier and the customer respectively.

4 RFID-ARDUINO APPLICATION

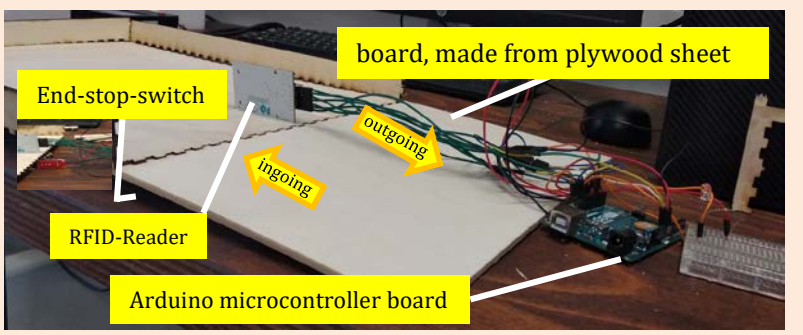

Figure 3: Model of the Logistic Cell

For the demonstration and educational purposes a practical model has been implemented (see Figure 3). This logistic cell model consists of a board, made from a plywood sheet, a forklift truck, an Arduino microcontroller board, an end-stop-switch, and an RFID-Reader.

5 CONCLUSION & OUTLOOK

Conclusion

- General logistic cell was developed;
- WITNESS-Simulation was done and principles of RFID-based logistic process were shown;
- IoT application connected with the RFID-Reading process, associated with the material, energetic and informational transport process was developed for demonstration and educational purposes.

Outlook

- Decision processes with Artificial Intelligence (AI) e.g. WITNESS and PROLOG [4] combination.

REFERENCES

[1] Luhmann, N. (1997). *Die Gesellschaft der Gesellschaft*. Suhrkamp Verlag, Frankfurt/Main.

[2] Spencer-Brown, G. (2008). *Laws of Form*. Bohmeier, Joh.

[3] Heiden, B., B. Tonino-Heiden, M. Roth, P. Nicolay, X. Mingxing, S. Walder, W. Wissounig, and W. Maat (2019). Orgiton Theory (unpublished work).

[4] Sterling, L. and Shapiro, E. (1994). The Art of Prolog. MIT Press.