Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 192 (2017) 207 – 212

Procedia Engineering

www.elsevier.com/locate/procedia

TRANSCOM 2017: International scientific conference on sustainable, modern and safe transport

Interactive design of reconfigurable logistics systems

Radovan Furmann[a]*, Beáta Furmannová[a], Dorota Więcek[b]

[a]*University of Žilina, Faculty of Mechanical Engineering, Department of Industrial Engineering, Univerzitná 1, 010 26 Žilina, Slovak Republic*
[b]*University of Bielsko-Biala, Department of Industrial Engineering, Bielsko-Biala, 43 309, Poland*

Abstract

Presented article reflects the demands of reconfigurable logistics systems design, within the Industry 4.0 initiatives meaning. When planning logistic systems, it is very important to interconnect the real data from the control systems of logistic resources with the monitoring system. Subsequently, interactive design takes into account actual requirements of the real systems. Methodology of interconnection of the real logistic elements with interactive projection planning system and process simulation will be described in the article. Mentioned projection planning system also uses genetic algorithms to support subsequent design of production layout with respect to the real requirements of logistics systems.

Peer-review under responsibility of the scientific committee of TRANSCOM 2017: International scientific conference on sustainable, modern and safe transport

Keywords: Internal logistics ; dynamic simulation ; interactove projection system ; genetic algorithm

1. Introduction

Logistics is increasingly the motor of success of industrial organisations on global markets. Globalisation brought not only the potential of global market, disturbance of market barriers and free movement of capital, but also global competition and so far unknown speed by which market turbulences appear. The current effort of modern logistics systems projectants is, when designing these systems, to build into their features the ability of fast adaptation to changing market conditions. These systems are, at present, called adaptive logistics systems which use, for the ensuring of adaptability, new types of technologies also on the basis of computer emulation.

* Corresponding author. Tel.: +421-041-513-2711; fax: +421-041-513-1501.
E-mail address: radovan.furmann@fstroj.uniza.sk

Peer-review under responsibility of the scientific committee of TRANSCOM 2017: International scientific conference on sustainable, modern and safe transport
doi:10.1016/j.proeng.2017.06.036

2. The current situation in logistics

Reconfiguration of logistics, as well as adaptability, is based on the current need to project logistics concepts in smart factories. Logistics systems are made of hardware, software and peopleware elements. Digitization in 21st century has dramatically increased importance of software. The dynamics of digitization, the huge growth of computing power, miniaturization, development of software services, related to the use of artificial intelligence, Internet of things and clouds enabled implementation of the intelligent elements directly to the logistics facilities (called nested intelligence).

The second decade of 21st century brought another revolution change. Modern real factories, using the most advanced technologies, as denoted as Smart Factories. This paper reacts to the rising need to project intelligent plants with reconfigurable logistics systems. Adaptive logistics system currently use great amount of data. Given amount of data about internal and external factors, formed as a result of massive use of sensors, allow to process new technologies for Big Data. Extraction of information and knowledge from data brings the new era of knowledge engineering, when the knowledge is not created by a man, but they are also the result of data processing by information systems.

Software and software services and their development became the condition for the further development of logistics. Software services represent nowadays the crucial factor of competition ability of logistics solutions. It can be seen literally on every step. Pallets, containers, conveyors, robots, mobile robotics, reservoirs, storages - these all become intelligent and able to mutually communicate and make decision. Software therefore gradually becomes the thing which decides about the amount of added value which is created by logistics and which becomes the part of added value of product. Software and software services therefore directly become to affect the quality and price of products. By connecting the dynamic simulation (digital world) with real logistics systems (real world) through intelligent sensors (virtual world) will create the complex solution which will reflect on the requirements of industrial plants to build so called intelligent production and logistics systems. [1,2]

3. Digital twin in logistics

Technological concept Digital twin is functional system for the continuous optimization of logistic processes and it is formed by the connection of real logistics with its own digital "copy". It creates an environment of digital factory, in which the company can optimize the logistics directly during the production process, change the parameters and configuration of logistics in real time. Data that arise during this time form a comprehensive picture of the logistics. Data are collected and continuously evaluated by the Digital twin. Among other things, this allows to shorten and streamline material handling process, optimize logistics processes and performance of the staff that ensure logistic processes. [3]

At the Department of Industrial Engineering, University of Žilina in cooperation with technology partners CEIT and EdgeCom we develop our own approach to reconfigurable logistics, as shown in Fig. 1.