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Procedia Computer Science 103 (2017) 142 – 147

Procedia Computer Science

XIIth International Symposium «Intelligent Systems», INTELS'16, 5-7 October 2016, Moscow, Russia

Product lifecycle management using multi-agent systems models

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Abstract

The article describes application cases of intelligent systems technologies in modern product lifecycle management system. Basic terms and definitions of product lifecycle management (PLM) practices and intelligent systems enumerated. Intelligent solutions based on PLM and logistic support analysis (LSA) methods proposed. Multi-agent software system for PLM and LSA related tasks solving and automation presented.

Peer-review under responsibility of the scientific committee of the XIIth International Symposium "Intelligent Systems"

Keywords: Intelligent systems; product lifecycle management; logistic support analysis; multi-agent software

1. Lifecycle management

Lifecycle management is one of the major challenges in modern complex technical products development and production. Lifecycle management appliances allow significantly reduce costs and improve product.

Product lifecycle management – multilevel product characteristics control on all product lifecycle stages[1]. The main objective of lifecycle management is the effective implementation of programs and performance requirements specified in product development and minimizing the life cycle costs. Controllable modifications of product, it's production and exploitations systems are common life cycle management technics. Methodical and informational support are necessary for effective lifecycle management. Effective tools for solving lifecycle problems and challenges are Product lifecycle management (PLM) systems.

Fundamental PLM problem may be considered with control theory point of view. It should be noticed, that PLM systems are distributed in time and space and cover all lifecycle stages. One of most effective technologies for

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Peer-review under responsibility of the scientific committee of the XIIth International Symposium "Intelligent Systems"
doi:10.1016/j.procs.2017.01.034

intelligent distributed system development is multi-agent method. Common structure of integrated PLM system presented at figure 1.

2. Multi-agent systems

Multi-agent system (M.A.S) is computer system composed of multiple interacting intelligent agents within an environment. Agents can interact with each other and passive environment. Main concept of agent's technologies effectively adopted in most frames of applicable and system programming, artificial intelligence scope and distributed systems. One of fundamental formal description of M.A.S. agents was introduced by L. Gesser in his book "MACE: A flexible testbed for distributed AI research" [2]. In accordance to L. Gesser agents described by following set of properties:

- Class – group of agents, identified by class name
- Name – every agent has unique name in class, so agent can be uniquely identified pair of string: class and name
- Role – description of role, executed by agent in class scope
- Skills – variety of agent abilities
- Goals – variety of goals, that agent tends to achieve
- Plans – roadmap of agent actions

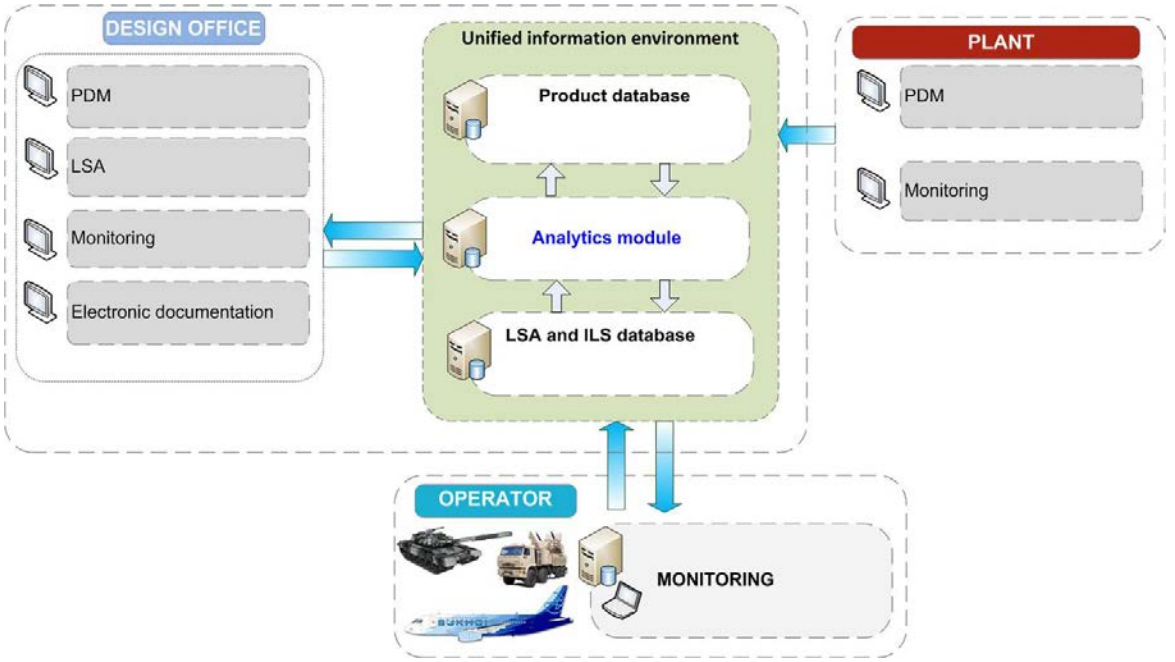

Fig. 1. Common PLM system structure.

Agents can communicate with environment by messages and each other throw unified information environment. One of possible implementation of this environment is database with network access. Primary feature of agent is ability to produce "actions".

In this article presented multi-agent model of automated lifecycle management information system (ALMIS). In this model agents are different specialized automated workstations. ALMIS is distributed multi-user interactive system, designed for effective lifecycle management of complex engineering products like armored vehicles. Main goal of this system is to provide analytical reports and additional information for decision-maker. Decision-maker