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Ontological modeling of satellite′s manufacturing work flow instruction

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Abstract

The article describes the ontological modeling of formation manufacturing work flow instructions. Ontology inspection of incoming goods is exposed to more detailed consideration. Ontological modeling was performed using Fluent Editor. Fluent Editor is an instrument of creation of ontologies based on Controlled Natural Language (CNL). Functional ontology visualization was described method of creation and verification instructions ontology. The analysis was performed on methods of creation ontology and its verification using visualization instrument. Ontology instructions can be used as a basis for the development of information systems instruction execution in this or related engineering fields. In the future, this information system can be used as an electronic assistant supervisors conducting inspection on any instructions or manuals. Ontological modeling makes a transition from document-centric from data-centric system with different kinds of checks or inspections.

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Keywords: ontology, instruction, Fluent Editor, verification.

1. Introduction

Improving efficiency is an essential feature of any process. The man invents new ways to machine implementation for routine work for the growth of the positive results from these processes. Now to increase the efficiency of processes associated with the transfer and storage of information, a variety of software products used for these tasks. The software product is determined according to the type information interpretable. Software products provides the ability to automate a wide range of tasks. For example, document reduction, business process modeling, etc.

In this paper, main attention is paid formalization of knowledge, operations, procedures, and represented the semantic modeling of the selected domain. One means of semantic modeling is an ontological representation of the data [1, 2].

The domain ontology is an integrator of databases, knowledge, procedures and operations. Typically, such a scheme consists of a data structure containing all the relevant object classes, their relationships and rules (theorems limitations) adopted in this field [3]. Through a structured approach to the description of domain, ontology is often used to formalize business processes. The ontology are used to improve the efficiency of distributed interconnected objects Ontologies improve the interaction of distributed systems by describing the metadata of related business objects [4].

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2. Transition from document-centric to data-centric system

Currently, during the inspection of the airplane applied document-centric system of checks and controls executed works. In such a system at input are made of paper or electronic documents. These documents are kept in the documents store in parallel document structure and do not communicate with each other.

Disadvantage of the document-centric system is request any value from storage, the output is a document. Manufacturing work flow instruction implementation - highly organized operation. To reduce the time needed for its implementation brevity and organization information. The use of text documents for the organization of interaction between specialists at the preflight inspection increases the time for its implementation.

The peculiarity of data-centric system is a retention information in data store. Data is read from the input document. Unlike document centric system, data is requested from the data-centric system. At the output, documents may be generated on a template of the collected data.

By using data-centric system during inspection of the manufacturing work flow instruction is possible reduce the time for its implementation, create a system of data exchange between specialists during the inspection.

Due to the ontological modeling the manufacturing work flow instruction transition from document-centric system to data-centric system. It reduces the time required to transfer data from the performer to the customer, and the execution of the form becomes a modern kind of data.

3. Instruments of ontological modelling

Visual design methods of ontology contribute to a faster and complete understanding of the structure and knowledge of any subject area, which is invaluable checking the quality of the described knowledge. Requirements for the instrument:

1) Ease of use. For example, use of natural language.
2) Availability of visualization. Graphical display of all subjects, objects and relations between them in the manual should be simple and clear.
3) Support of different formats for integrating the ontology.

In this article, we propose to use ontological editor Fluent Editor as a tool of creation an ontology instruction for the plane examination. Fluent Editor uses English as the Controlled Natural Language (CNL) [5].

CNL is the mechanism for develop ontology by Fluent Editor where there are simple rules of sentences formation, peculiarities of construction of classes, subclasses, copies and the relations between them. Advantages of using CNL:

• Easy descriptions and simplified understanding of the subject area in a natural language. Using natural language makes it clear to more people in the writing the ontology.
• Unification of the language rules by CNL. Strict rules of controlled languages define the structure of the description of the subject area.
• Ease of visualization of ontology in the form of a CNL-diagram

Using the CNL for building ontology removes the user's skills with programming languages such as OWL, RDF, etc.

4. Ontological model of instruction

4.1. Description of the processes

Domain - the set of all objects, properties and relations between them are discussed in scientific theory. In the logic of - the domain of possible values of the variables subject logical language [6]. In recent years, more and more widespread use of gets ontological model to describe the domain [7, 8].

The work in the measurement laboratory for quality control of the mechanical parts of small satellites is in line with the entire production process for the components corresponding to the production planning. The process steps of quality control are carried out at fixed points of the production; see Figure 1 [9].