TEKA. COMMISSION OF MOTORIZATION AND ENERGETICS IN AGRICULTURE – 2014, Vol. 14, No.1, 305-311

Implementation of an information subsystem of a reference library information modern e-learning

Uriy Tihonov, Vitaly Semenkov

Lugansk Taras Shevchenko National University,
Oboronna str. 2, Luhansk, 91011, e-mail: t2003i@mail.ru, semvitaliy@gmail.com

Received January 24.2014: accepted February 05.2014

S u m m a r y . It is proposed further development of instrumental complex ontological destination designed to provide integrated information technology automated construction of ontologies subject area. The results are focused on the solution of practical implementation of the information subsystem, building software model of library reference information, modes of operation and its interaction with other subsystems of the complex.
K e y w o r d : library reference, the ontological description of the subject discipline

INTRODUCTION

The development of the concept of knowledge-based society, of transdisciplinary research in which information technologies unite society in the system and development of the technologies themselves affect the architecture of the knowledge-oriented information systems [8, 9, 17, 20], stimulating in turn, the development of methods of automatic construction of formalized ontology based on the analysis of natural language objects- (for extraction of knowledge) [18, 19], as well as applied aspects of ontology development, in particular for the construction of e-learning courses[13], and systems integration metaontology knowledge [4], service-oriented systems, etc.

MATERIALS AND METHODS

The paper used description of block diagram different modes of the program, a Java library.

The article emphasizes information on the development of software and models of development and improvement of e-learning [21], in particular for constructing e-learning courses oriented on ontology subject disciplines of structural units (department, faculty) University.

The paper used system-ontological domain analysis [15], ontological methods and means of processing of subject knowledge [13, 14], program model [14].

The logical model, which can use various logical aspects of knowledge representation [12]. Propositional logic is a complete [7], a system of iterative construction and parsing logic statements, which is the atomic structure for the components of which it is impossible to establish the truth.

Designing electronic course (EC) involves the formation of sets of concepts.

Basic principles of the paradigm of computer ontologies have been formulated in [6].

In contrast to the knowledges encoded in the algorithms, an ontology provides a unification [1-3]. and their re-using in different research groups on different computer platforms for solving various problems [4, 10-11].

Used subset of the concepts of the ontology database [13].

Statement of the problem. The material is the result of the continuation of research initiated in [14-16], which considered the appointment, architecture and formal models of instrumental complex ontological destination, which realizes integrated information technology of automatic construction of domain ontologies and system integration of domain-specific knowledge [16]. The article considers the problem of choosing a software platform implementation of one of the core modules of the information subsystem-library reference information (LRI), of the development of the architecture and algorithms of functioning units LRI module, as well as their interaction with other modules and implementation modes of operation.

Description of the software platform. LRI software module (hereinafter simply LRI) is developed at object-oriented programming language Java, having advantages of cross-platform and flexible security system. Java programs are translated into byte code that is interpreted (executed) on a virtual machine Java.

Redis. To store dictionaries LRI is used Redis - document- oriented network of data store such as “key-value” open source. The system keeps a database in RAM, equipped with mechanisms to preserve the database file (image) and logging in permanent storage of information. The main feature of the system is to support the Redis data values of the following types:

- string (this type allows you to store an arbitrary number or serialized object, while supported by special operations, which treat the string as an integer),
- linked list,
- set,
- assorted set,
- hash table, on which operations are performed atomically.

Redis runs on most POSIX systems such as Linux, BSD, Mac OS X without any additions.

Each of five data structures used Redis has at least a key and a value.

The key is intended to indicate the semantics of information. He is represented as follows: users: alex and contains information about a user named alex.

Value - is the data that is associated with the key. They may have different meanings - strings, numbers, or serialized objects (in the form of JSON, XML or any other format). Redis, mainly considers the value as a byte array and not the “interests” of their semantics.

Key and value - these are the basic concepts of Redis. They are treated with two teams - this team **get** and **set**. The set command takes two parameters: key, which is then saved, and the value associated with it.

To get the value for the key, use the command get, which returns a value corresponding to the key. For example, the team **get** users: alex, is to get the value for the key, which returns a value corresponding to the key.

The main functions of the program module LRI.

1. Providing two modes of operation of the module:

a) as part of a tool set of ontological appointment,

b) off-line (as a separate software system).

In standalone mode, using the control module, you can view terms and their definitions.

2. Viewing dictionaries for an arbitrary concepts.

3. Representation for concepts multiple definitions.

4. View mode of the concepts and definitions (the default).

- Other definitions (specific concepts).

-View mode of ontological description (fragment ontology) concept and its connection with the upper and lower levels.

5. Authorization of users. There are two types of authentication: for “User Mode” -

without password and “edit mode and filling” - requires an account on the server (username and password).

6. Search term by LRI (on all components).

7. Storage of concepts and of their definitions in the system Redis - document-oriented networked storage of data such as “key-value” open source.

8. Entering a new concept and its definition from the keyboard or with the digitized source.

9. Establishing links between the concepts that already in the LRI.

10. Graphical representation ontology (visualization ontology) and of fragments.

Options of autonomous mode LRI used in the application instrumental complex ontological destination (ICOD) – for automated preparation of e-learning course.

Digital libraries are significant public knowledge resources within a domain similar application area and in this sense they are invariant under the adaptation and optimization of the ontological system to the target application, in particular, in the problem of adapting to automate the development of e-courses on a particular subject discipline.

The algorithm of the program. LRI module consists of three sub-systems, and combines information resource, software and hardware subsystems and natural intellect. A generalized block diagram of the LRI module are showed in Fig. 1.

Subsystem the **information resource** consists of a specialized database Redis, which provides content ICOD. The database contains digitized encyclopedias, thesauruses and dictionaries, as presented in the form of descriptions of knowledge.

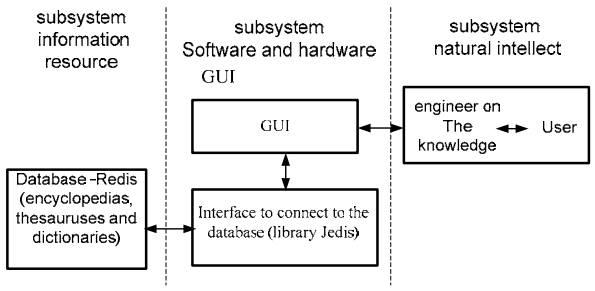

Fig. 1. Generalized block diagram of the LRI module

Subsystem software and hardware includes a block of connection to the database and graphical user interface (GUI) that allows the interaction between the user (teacher) or a knowledge engineer to work with LRI.

Subsystem **natural intellect** (knowledge engineer and / or teacher) provides content dictionaries LRI provides control and validate the contents of an information resource in case of errors or inaccuracies – edits.

Choice of modes of operation. Depending on the type of program are two modes:

- Custom mode,
- Mode filling dictionaries.

After starting the LRI module opens a window for selecting the operating mode (Fig. 2), where you can select one of the above modes and click “OK” to confirm the selection.

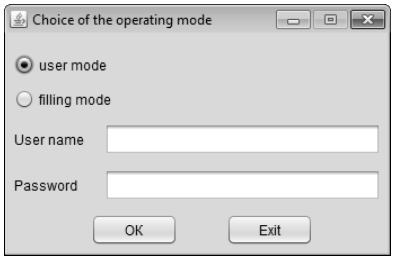

Fig. 2. Choice of the operating mode of the program

User mode. If you select “user mode” runs the main menu, shown in Fig. 3. To start working with the program, the user must select in drop-down list “Choice of SA” the desired subject area, then from the drop down menu “Choice of dictionary SA” select the desired dictionary given domain. After that a program, in the corresponding area of the window, will show the concepts corresponding to the selected domain dictionary.

For show a description of the concepts it is necessary to double-click on it to cause the corresponding description, shown in Fig. 4. By default, displays one of the most used definitions – “default definition”.

If this concept in LRI has several descriptions or definitions is in other languages to display them on the screen a button “Other definition…” (Fig. 5).

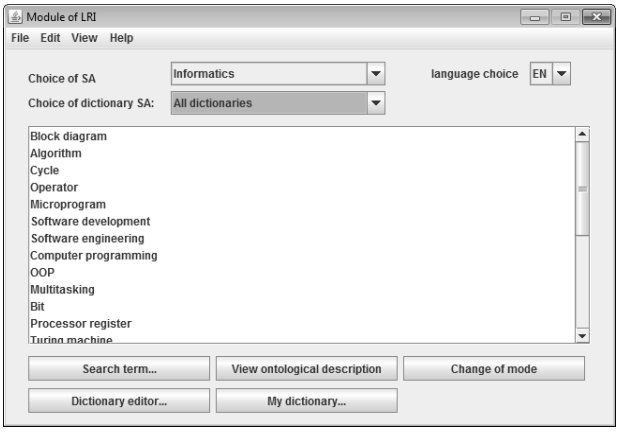

Fig. 3. Main menu

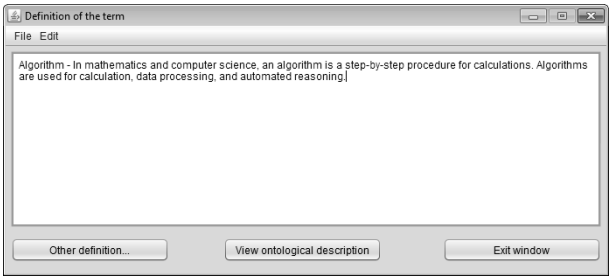

Fig. 4. Window description of the term.

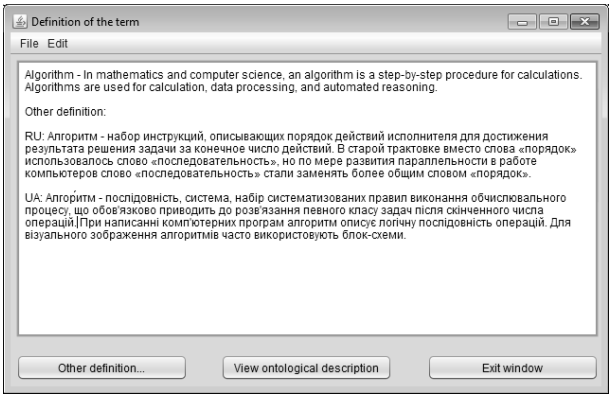

Fig. 5. Window description of the term with use additional definitions

If there is a term in describing the concepts contained in any dictionary of LRI, then the term will be highlighted in the text in a different color (Fig. 6). Thus provided a relationship between the concepts in the library LRI.

To search for concepts and their descriptions by LRI it is necessary to press “Search term…” in the main menu (Fig. 3). This will open a search window (Fig. 7), in which you must enter a word or phrase in a search string and select vocabulary of domain from the drop down list.

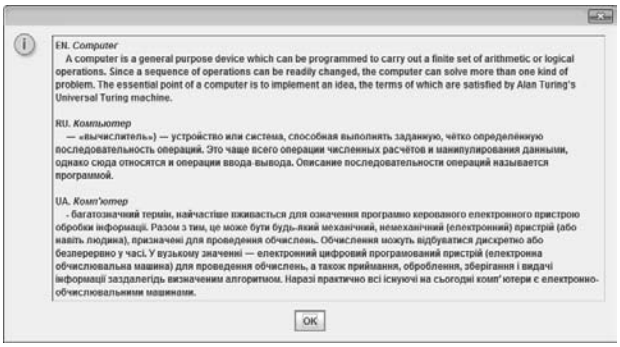

Fig. 6. Window of descriptions with backlit of related concepts

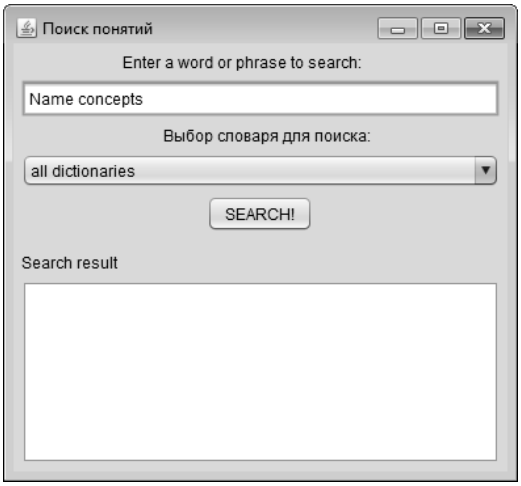

Fig. 7. Search box

To search the entire LRI need in the dropdown list leave the default choice – “all dictionary”. After clicking on “Search” in the field to display the results search will be displayed concepts that found or more terms with indicating of the dictionary in which they are contained. To display a description of the terms that is found, to double click on a search results.

To display a description of the terms that is found, to double click on a search results.

Below is a general block diagram of the module LRI in user mode (Fig. 8).

Mode filling dictionaries. Selecting the edit mode. Mode filling dictionaries includes all the functionality that mode of use, as well as expanded features and content editing sections LRI. To enter to mode fill in the main menu (Fig. 3), press the button.

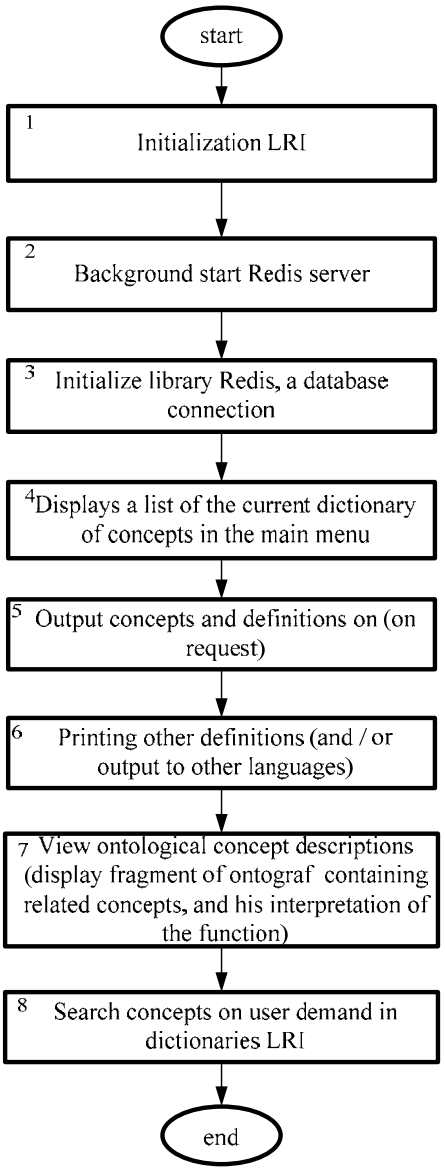

Fig. 8. General block diagram of the module LRI in user mode

"Change mode" in the window that opens, select "Filling mode" and click "OK".

After that, in the main menu is activated button "Dictionary editor...". For realization of mode filling dictionaries must click "Dictionary editor...", and the dialog box will appear, shown in Fig. 9, in which you must select one of the editing modes:

- Manual editing,
- Automated edit mode.

Manual editing of dictionaries. The manual editing dictionaries LRI - editor window, shown in Fig. 10.

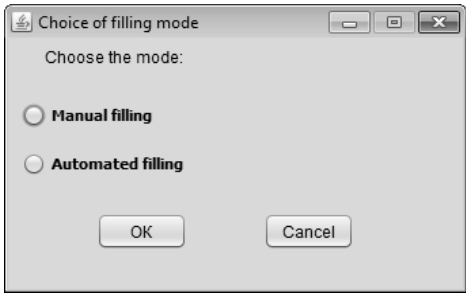

Fig. 9. Selecting the editing dictionaries LRI

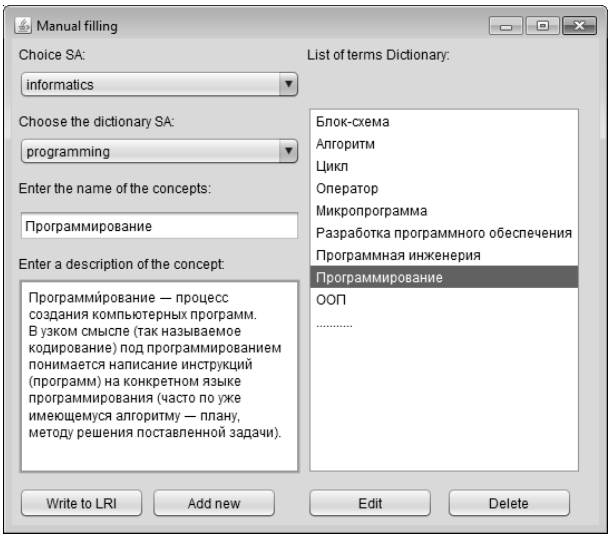

Fig. 10. Manual editing LRI

In the list drop-down left of the editor window you must select the desired subject area, and then select its dictionary. In the right pane displays a list of concepts from the dictionary.

To add a new concept into the dictionary it is necessary to press the "Add new", then the text fields.

"Enter the name of the concepts" and "Enter a description of the concepts" will be available to fill (Fig. 11). Next, enter the name and definition of a new concept in the appropriate fields and click on "Write to LRI". A new concept and its description will be added to the LRI.

To modify existing concepts (e.g., in case of errors or omissions in the description of the concept), select it in the display list of terms and click "Edit" and then the name and description will be displayed in the appropriate fields. When you finish editing the concept and its definition click "Write to LRI" to save the changes.

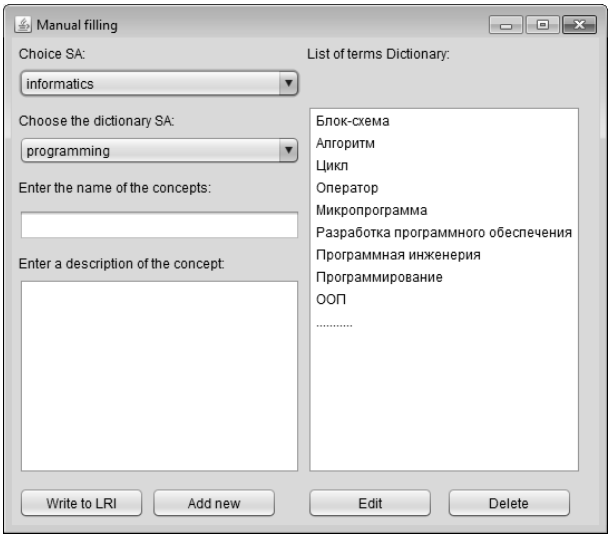

Fig. 11. Manual editing LRI - Enter a new concept

To remove concepts must select it in the list of terms and click “Delete”. After this concept with its corresponding description will be removed from LRI.

Mode Automated edit dictionaries. When choosing an automated editing LRI - opens editor window, shown in Fig. 12, in which you need to click “Open...” and specify the path to the digitized source containing concepts and their descriptions. Then choose the desired subject area and its dictionary from drop-down lists that are added by the new concepts and their descriptions, and then click “Save” to complete the operation. New terms and their descriptions will be added to the selected dictionary.

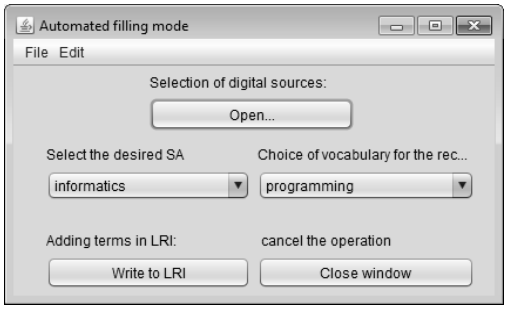

Fig. 12. Automated filling mode LRI

Fig. 13 is a general block diagram describing the algorithm of the LRI module in user mode.

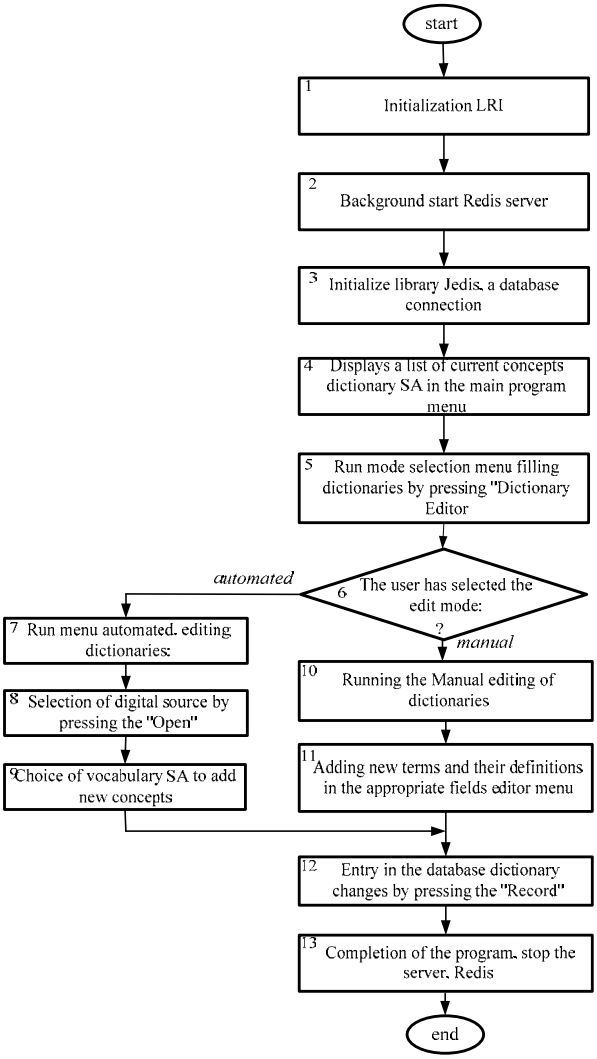

Fig. 13. Generalized algorithm of the module LRI in filling dictionaries

CONCLUSIONS

1. In this paper we proposed development of an approach to solving urgent problems of constructing formal ontologies based on the analysis of natural-language objects, developments of aspects of application of ontologies, in particular for the construction of e-learning. Described two main modes LRI, is showed windows, menus, is described purpose and as work with them. The next steps of development of the system is to implement and filling LRI by the real volumes of background information.

2. LRI as part of ICOD will improve the efficiency of applications. In particular, the solution to the problem of automatic construction of courses education will improve

the quality of content due to their significance, due to reducing the time to create and configure a specific contingent training. In addition, the problem will disappear replace the teaching staff.

REFERENCES

1. **Bechhofer S., Horrocks I., Goble C., Stevens R., 2001.:** OilEd: A Reason-able Ontology Editor for the Semantic Web // Joint German/Austrian conf. on Artificial Intelligence (KI'01). Lecture Notes in Artificial Intelligence LNAI 2174, Springer-Verlag, Berlin, 396-408.
2. **Chaudhri V., 1998.:** OKBC: A Programmatic Foundation for Knowledge Base Interoperability. V. Chaudhri, A. Farquhar, R. Fikes P. Karp J. Rice // Fifteenth National Conf. on Artificial Intelligence. AAAIPres/The MIT Press, Madison, 600-607.
3. **Domingue J., 1998.:** Tadzebao and WebOnto: Discussing, Browsing, and Editing Ontologies on the Web // Proc. of the Eleventh Workshop on Knowledge Acquisition, Modeling and Management, KAW'98, Banff, Canada.
4. **Farquhar A., Fikes R., Rice J., 1997.:** The Ontolingua server: A tool for collaborative ontology construction // International Journal of Human-Computer Studies, 46(6), 707-728.
5. **Fernandez M, Gomez-Perez A., Pazos J., 1999.:** A Building a Chemical Ontology Using Methondology and the Ontology Design Environment // IEEE Intelligent Systems, Jan./Feb. 37-46.
6. **Gruber T.R., 1993.:** A translation approach to portable ontology specifications / Gruber T. R. – Knowledge Acquisition, 5 (2),– 199-220.
7. **Guc A.K., 2003.:** Mathematical logic and the theory of algorithms: a training manual A.K. Guc-Omsk: Publisher of "Heritage". Dialog-Siberia 2003. – 108.
8. **MacGregor R., 1991.:** Inside the LOOM classifier // SIGART bulletin, Vol.3, No.2, 70-76.
9. **Motta E., 1997.:** Reusable Components for Knowledge Modelling // Ph.D. Thesis. The Open University.
10. **Musen, M., 1998.:** Domain Ontologies in Software Engineering: Use of Protege with the EON Architecture // Methods of Inform. in Medicine, 540-550.
11. **Noy N., 2001.:** Creating Semantic Web Contents with Protege-2000. N. Noy, M. Sintek, S. Decker, M. Crubezy, R. Fergerson, M. Musen // IEEE Intelligent Systems, March/April pages 60-71,
12. **Novikov F.A., 2000.:** Discrete mathematics for computer programmers / F.A. Novikov. – St. Petersburg.: Peter, 304,
13. **Palagin A.V., 2010.:** On the automated construction of ontology for the discipline of electronic courses II / [Palagin A. Petrenko, N. Tikhonov, Y., Velichko VY]. – publisher VNU named. Dahl. – 2010. – № 4 (150). – 171-178.
14. **Palagin A.V., 2012.:** Ontological methods and means of processing of subject knowledge A.V. Palagin, S.L. Kryvyj, N.G. Petrenko [Monograph] - Lugansk: publisher VNU named. Dahl, 2012. – 323,
15. **Palagin A.V., 2009.:** system-ontological domain analysis / A.V. Palagin, N.G. Petrenko. – USiM, – № 4. – 3–14. (in Russian).
16. **Palagin A.V., 2012.:** Program model ICOD: biblioteka slovarej SA / [A.V. Palagin, N.G. Petrenko, V.Ju. Velichko i dr.]. – Vestnik VNU im. V. Dalja, Lugansk: Izd. VUGU. – 2012. – № 8 (179). – 151–157. (in Russian)
17. **Robinson J., 1988.:** Logic Programming - Past, Present and Future / J.Robinson. - In the book.: Logic programming. M.: Mir, 1988.
18. **Sowa J.F., 2000.:** Knowledge Representation: Logical, Philosophical, and Computational Foundations / J. F. Sowa – Brooks Cole Publishing Co., Pacific Grove, CA, 2000. – 594,
19. **Sure Y., 2002.:** OntoEdit: Collaborative ontology development for the Semantic Web. Y. Sure, M. Erdmann, J. Angele, S. Staab, R. Studer, D. Wenke // In Proc. of the Inter. Semantic Web Conference (ISWC 2002), Sardinia, Italia, June 2002.
20. **Voronova A., 2010.:** Information technologies in public administration practice, TEKA Kom. Mot. I Energ. Roln. – OL PAN, 10D, 313-317.
21. **Zharikov E., 2010.:** Topical questions of implementation of information services in a network of University, TEKA Kom. Mot. I Energ. Roln. – OL PAN, 10B, 331-337.

РЕАЛИЗАЦИЯ ИНФОРМАЦИОННОЙ ПОДСИСТЕМЫ БИБЛИОТЕКИ СПРАВОЧНОЙ ИНФОРМАЦИИ В MODERN E-LEARNING

Александр Палагин, Николай Петренко, Виталий Величко, Геннадий Могильный, Юрий Тихонов, Виталий Семенков.

Аннотация. Предлагается дальнейшее развитие ИКОН, предназначенного для реализации интегрированной информационной технологии автоматизированного построения онтологий ПдО и ПдД. Полученные результаты ориентированы на решение задачи практической реализации информационной подсистемы, построения программной модели БСИ, режимов функционирования и ее взаимодействие с другими подсистемами комплекса.

Ключевые слова: библиотека справочной информации, онтологическое описание предметной дисциплины.