Knowledge Systems Applications Based on SW AToM

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ABSTRACT

The article presents the knowledge systems developed by using the software AToM and the experience with their application for teaching and universities cooperation. The theoretical bases of the solution are Topic Maps; the software AToM is described and individual cases of the knowledge systems are introduced. The article reflects the years of experience in the cooperation of the knowledge systems development with the AION CS Company. Two examples are presented in detail: “Conferences” – knowledge system used for education and “MilUNI” – system for military universities cooperation.

KEYWORDS

Knowledge System, education, university cooperation, Topic Maps, AToM, MENTAL, MilUNI.

1 INTRODUCTION

The joint article of the software company representative, the AToM (Aion Topic Maps Engine) software (SW) creator, and the representative from a university environment presents several years of experience in the creation of knowledge systems and an indication of their potential to support teaching and university cooperation.

First are introduced some examples of using the software AToM for creating knowledge systems, which have become the source of our experience and lessons learned as well as the cornerstone for further application in the university environment. Second is given information about SW AToM and third are described “Conferences” and “MilUNI”.

1.1 Digital Encyclopaedias

In the past, encyclopaedias were the carrying projects of AION CS, Ltd. The most important Czech encyclopaedias were digitized in the range of many tens of thousands of pages [1] and were presented in various forms - from CD versions, via web applications to content management systems intended for the preparation of new encyclopaedias. The main advantage of the AToM environment in terms of encyclopaedia makers is the repeated use of information for typesetting of books and creating of web or mobile applications.

1.2 The Project MENTAL

The research defence project “Knowledge Management of the ACR NEC - MENTAL” [2] resulted in a Knowledge Management System (KMS) whose aim was “to carry out the analysis of knowledge approaches, ontologies and ontology languages, and to assess their suitability for using them in the Army of the Czech Republic (ACR); to propose a methodology for knowledge systems development in the ACR; to elaborate a knowledge system proposal in the ACR NEC administration and to implement it.” [8]

1.3 „Laws for People“ – a New Concept of the Legal System

The service Laws for People brings the users the regulations of the Law Digest of the Czech Republic in the current consolidated version [3]. It is accessible for free, without registration, with easy use, simply "for people", yet with many unique features allowed by the AToM SW application. The Laws for People was launched in the summer 2011 and has been visited by unexpectedly large audience in the Czech and Slovak Republic.

1.4 The Project MilUNI

The aim of the knowledge system Military Universities [4] (MilUNI) is to provide an explicit platform for the cooperation of military universities in teaching, research and exchange of teachers and students.
The system contains information on universities, their structure and focus, members of universities; it includes publications from conferences in full text so that they can be studied or cited by partners.

1.5 Knowledge System “Conferences” for Education Support

The knowledge system “Conferences” is an simple system about conferences that is used for education. The complete methodology developed in project MENTAL [2] is applied. The steps of the methodology are father explained.

2 SOFTWARE ATOM

The software AToM, based on Topic Maps (TM) concept, is briefly characterized, its principles of operation are described and now some details of functional possibilities are added in this chapter.

2.1 ISO Standard 13 250: Topic Maps

The TM model consists of the three basic elements: topic, association between topics, and occurrences of the topics [5]. The TM is standardized in ISO/IEC 13250:2003. Each topic represents just one subject and it can be anything: a person, thing, entity, process, etc.. It is a place in TM where all known information on the given subject is available by means of relations and occurrences. Subject is a part of the real world, which is described in TM. Associations represent relationships between topics, are bidirectional, and express unary, binary, or N-nary relationship between subjects. Occurrences are formed by information relevant to a given topic; they can refer to information or they might just contain it.

2.2 Implementation of TM in AToM SW

One of the goals and benefits of the AToM SW is to support the implementation of projects of knowledge systems, especially effective development of powerful web applications. This has necessitated some extensions or specification of the TM standard. Changes in the processing of occurrences of classes, work with associations and development of the user interface, to name some of them.

2.3 Extending Internal Occurrences

A simple set of basic features for TM Internal Occurrences has been renamed to a Variant type property. The following data types have been further complemented:

- Code and Ident – for the unique identification of the entity, where uniqueness is checked directly in the SW.
- Group Tree – a simple built-in taxonomy. Taxonomy is the fundamental building block of knowledge systems; in the TM standard it is necessary to create them always from the beginning, which is time consuming and difficult to maintain.
- Selection – forms a one-level code list, applied cardinality 1: N and M: N.
- Text – this feature allows inserting text in XHTML; provides the built-in text editor.
- Picture, File – storage of images and files.

2.4 Extending or Changing Associations

In the definition of associations the following changes were finalized:

- Order (Sort) – each association can provide a structure of embedded occurrences.
- Power of relationship in % (Rate), e.g. to express supplier-consumer relationship.
- Hierarchy – a special type of association for Parent-Child relations. This feature is for example the basis for hierarchical view of documents related to legislation within the service Laws for People (see 1.3).
- The starting types of the AToM SW associations are binary associations. Unary associations are replaced by an extended set of features; especially Group Tree and Selection. The main reasons for the use of N-nary associations are addressed through Sort, Rate and Hierarchy.

The above mentioned changes in associations are appropriately reflected in the creation of web applications in higher performance of applications and further in saving the lines of code which is needed for the service.

2.5 AToM Software

AToM is a SW for sharing data with co-workers, customers, or friends via web browsers. AToM is a non-programming web database SW that does
not require special knowledge. Anyone can easily construct a knowledge system on the web. The AToM web database can be used for intranets with more powerful features than typical shared spreadsheets like SharePoint or box.com. It can be used as a construction kit for building web applications with powerful information retrieval, and for various encyclopaedias, dictionaries, knowledge bases in applications where wiki approaches are not enough.

2.6 How Does It Work?

At first, create ontology of your problem domain in the Ontology designer module.

And after that you are able to work with data, realize information retrieval (see Figure 3) or even visualize them, see Figure 4. AToM Studio and Data Editor are the basic components of the AToM SW.

3 KNOWLEDGE SYSTEM FOR EDUCATION SUPPORT

The chapter presents the possibilities how to use the knowledge systems that apply AToM in learning and education. The procedure and method of teaching the knowledge approaches and creation of knowledge.
systems to students reflects the methodology used in the project MENTAL.
The sequence of work is based on the mentioned methodology. Its steps include:
1. Collecting information sources and their processing utilizing.
2. Clarification of the terms in the area in focus and verification them regarding the document base.
3. Ontology classes and associations design and their verification; the use of VUE SW.
4. Ontology characteristics design and their assignment to classes.
5. Editing the ontology into the AToM SW environment.
6. Creating a knowledge base.

At first, the basic concepts and work with information sources are introduced to students, and simultaneously, the used SW is described. The task assignment for student work is intentionally general and ambiguous, so that the students have to search their own approach to the analysis of information sources. For example:

“Analyse the information sources of the conference, produce an overview of the information systems field, the processing of knowledge, social networks and communication systems that were discussed at conferences”.

Without any more details stated in the assignment, the students are expected to carry out analysis of information sources, and to select the articles that cover the given field and examine them in detail. The students are supposed to find the details of each article (about the authors and their workplace, research and implementation tasks carried out, methods and tools used, the results obtained).

If the students’ reports on processing the information sources are not satisfactory, they have to correct them. At the same time, the students get familiar with the specific domain, as a preparation for building the knowledge base.

Consequently, the students are introduced to knowledge approaches, creating ontology and the AToM SW environment. The assignment is built on the previous activity; for example:

“Create a knowledge base on the conference; within the knowledge base, process selected articles on information systems, knowledge processing, social networks and communication systems”.

It results in the ontology design in Visual Understanding Environment [7] (see Figure 5), characteristics definition and their assignment to the classes (see Table 1).

![Figure 5. Ontology design on conferences](image)

Table 1. Classes and their characteristics

<table>
<thead>
<tr>
<th>Conference</th>
<th>Proceedings</th>
<th>Paper</th>
<th>TextOfPaper</th>
<th>Theme</th>
<th>Person</th>
<th>Organization</th>
</tr>
</thead>
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</tbody>
</table>

Then the ontology is prepared to implement into AToM environment and the knowledge base prepared, see an example in Figure 6.

![Figure 6. Ontology and data in the AToM environment](image)

The opportunity of the KMS for the learning results from its characteristics. The embedded information and knowledge can be divided into small parts and connected in a requirement net. The ontology driven system offers the chance to study various themes according ontology concepts (classes). Each occurrence of the class is a starting point for the new study problem, see Figure 7.
The next advantage is complex environment where it is no problem to add or to change a new study material.

3 KNOWLEDGE SYSTEM FOR UNIVERSITIES COOPERATION

The first aim of the knowledge system is to support the cooperation among NATO Military Universities and facilitate education and research of information about the universities’ members. In order to fulfill this goal, the content of the system was built according to a specific organization and has to respect the following:

- Universities and research organizations have to be related to the NATO countries, then European Union (EU) countries (non-NATO) and European countries (non-EU).
- The domains of interest include many fields of interest, as Military Science, Engineering, ICT, Medicine, Social Science, etc.
- The universities are linked to the countries and cities. They highlight international cooperation among educational institutions in the EU.
- The system contains NATO Centres of Excellence, Network Enabled Capability (NEC) events and institutions and is related to the field of interest.

The main feature of the MilUNI is a user-friendly access to the information about the structure of the system, its main educational areas, program of the faculties’ education, list of departments, research and conference activities, etc.

3.1 Related Works to MilUNI

A similar example of the military universities information source is the free encyclopaedia “Wikipedia”. On this website, we can find a heading named “Military Academy” [6]. The choice done by the system is to sort military universities by the country. Although this classification is easy to be executed, it does not permit the users to find a university by the domain of study.

The greatest advantage of Wikipedia is the fact that this encyclopaedia is free and so many people can add some information about the subject. It increases clearly the number of inputs into the information source.

There is a great risk to have erroneous information, and thus to harm the credibility of the information source because of the lack of hierarchy and user role. Wikipedia still remains an efficient model for obtaining a great quantity of information; however, we must stay aware that some of them could be wrong.

It is not difficult to obtain information resources on universities. Just enter the word “university” in the internet search engine and get a number of results, which are not organized and you can never be sure that the result is complete.

Another possibility is to find a link to universities in the national search engine or to search the site of the Ministry of Education with an overview of the universities, or find a website with a list of universities, e.g. http://www.vysokeskoly.com, where you can search high schools in the Czech Republic by type, orientation and geographic location.

All of these references, however, only lead to a basic overview of the university, mostly with regard to the needs of future students considering a university to enrol at; it is not a complex material supporting collaboration, and moreover, only in the national environment.

3.2 Ontology of the System

The contents of a knowledge system is defined in ontology which includes classes with attributes, relationships among classes, and a set of occurrences meaning specific contents of the knowledge system. The MilUNI ontology contains the following set of classes:

![Figure 7. Various starting points for the study](image-url)
3.3 Structure of the System

The system MilUNI consists (based on AToM SW) of the three frameworks:

1. AToM Studio – ontology definition and update, administration of users, data manipulation, portal formation, ...
2. Data Editor for data input and update
3. Knowledge Portal – user access

AToM Studio and Data Editor is described in the Chapter 2. Related to the MilUNI are shown user interfaces for Schema Editor (see Figure 8), for Data Editor (see Figure 9 and 10).

The Knowledge Portal (KP) covers the system MilUNI to shield users from details of knowledge system implementation. The KP is prepared as a typical portal template that is designed for any similar type of knowledge systems based on
AToM. KP MilUNI is a typical web application and is available at http://www.atom.miluni.eu/.

The KP consists of 3 types of pages:
1. Title page
2. List page with the result list
3. Detail page

KP includes some menus and boxes for access and search information. Almost all parts are under administration in the MilUNI ontology.

Content of the title page is the complete menu and search boxes with the actualities, see Figure 11.

The list page includes search result list in the form that correspond with the current menu choice, see Figure 12, 13, and 14.

The detail page includes information about the final class occurrence; see Figure 15 (class university) and Figure 16 (class conference).

3.4 MilUNI-State of Art and Father Development

The system is composed from the public resources of nearly 120 universities divided into 250 university parts (Faculties, Departments, etc.) in 40 countries, 130 cities. The domains of interest are subdivided into domain areas; they are linked to the conferences and papers.
The existing state of the MilUNI system development is only a starting point for its further improvement. The primary requirement of such a system is its acceptance and utilization by users. The author assumes that this process will take one to two years. At first, it is necessary to address colleagues from military universities who have already shown their interest in mutual collaboration, and to encourage them to use the system. Supposedly, these colleagues will inform their colleagues, and thus the awareness of the MilUNI platform for cooperation within military universities will raise. Naturally, an interest group will form which will secure the verification and editing of the existing data about each university, and then, step by step, they will add further information to meet the objectives of the knowledge system. It primarily includes research activities, publications in scientific journals and at conferences. This community will gradually make suggestions on the improvement of the ontology, and it will also put forward the requirements for adding other vital relations.

4 CONCLUSIONS

The article presents a large variety of areas and ways how the AToM SW was applied while creating the knowledge-based systems supporting learning and cooperation between universities. It also introduces the experience and the best method how to teach the creation of knowledge-based systems and how to use them in practice. The created knowledge systems based on the AToM SW are only at the mere beginning of the application process, but they convincingly demonstrate the wide range of application possibilities.

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6 REFERENCES