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## **MOBILE APPLICATION FOR THE ENGLISH-BELARUSIAN-RUSSIAN TECHNICAL DICTIONARY**

The article is devoted to the problem of creating multilingual electronic dictionaries. The authors offer an overview of current approaches in the field of computer lexicography. A mobile application to the electronic English-Belarusian-Russian dictionary of technical terms TechLex is presented. The developed application covers the following subject areas: architecture and construction, water supply, information technology, pedagogy, transport communications, economics and energy construction. It is created in Belarusian National Technical University by the 2<sup>nd</sup> English Department together with the Department of Software for Information Systems and Technologies.

**Key words:** *a multilingual electronic dictionary, computer lexicography, an electronic technical dictionary, a client-server application.*

**Introduction.** Modern computer lexicography has almost completely replaced traditional manual and handwritten lexicographical methods that existed for many centuries. Today there are a lot of new paperless information technologies. Modern applied linguistics offers a set of methods and software for creating dictionaries. The Central object of computer lexicography is an electronic dictionary, which can be defined as «any lexicographic work on computer media and equipped with automatic processing and filling programs» [1, c. 36].

The idea of creating electronic dictionaries arose from scientific investigations

that «determine the type and number of translator errors in the texts of various difficulties and the time for searching unfamiliar for a translator words in dictionaries and reference books» [2, p. 12]. Today electronic versions of various dictionaries are widely spread. In contrast to traditional dictionaries, an electronic dictionary contains not only texts and graphic images but also the whole range of media objects, including video and animation fragments, sound, music, graphics, etc.

All electronic dictionaries can be divided into two types: automatic dictionaries for a special user and automatic dictionaries for text processing programs (retrieval thesauruses, frequency dictionaries, rubricators, classifiers, morphological analysis dictionaries, automatic translators) [3, c. 21].

An important feature of the electronic dictionary is its hypertext nature. Links embedded in words, phrases or pictures allow the user to select a text or a picture and immediately display related information and media. The relationships between the components of a dictionary entry are not linear.

The relationships between the components of a dictionary entry are not linear. The dictionary entry has a clear logical structure with hierarchical relationships between elements. Each information category occupies a strictly fixed place – the «zone». Looking for particular information a user requests a specific parameter and is given access to selected pieces of the article. In accordance with the request only a single zone is activated so there is no need to browse the whole article.

Electronic dictionaries have significant advantages over their paper counterparts. As a result, there is the rapid growth of the market. Electronic dictionaries can fundamentally overcome the key contradiction of book lexicography: the more information the dictionary offers, the more developed its scientific vocabulary and it's more difficult to use it. This is especially evident for translation dictionaries. In this case, the dictionary answer can give a wide range of information about the word or phrase, not just a translated correspondence. It involves an active choice of the user from several possible well-founded alternatives. The electronic dictionary can be two or more directional that allows to translate words in both directions and even from one language to another by means of the third language.

Accessibility also plays an important role. Not every Belarusian city has paper editions of large foreign dictionaries. At the same time, there is a great number of free Internet resources that provide a variety of lexicographic materials. The interactivity of modern electronic dictionaries and their user-friendly interface are also attractive factors for the user.

Another important aspect should be mentioned: the relevance of lexicographical material. Most dictionaries, which were formed in the language atmosphere of the middle of the last century, are very outdated. Against the background of the rapid development of science and technology there are many new industries in all

spheres of human activity. So new words, terms, stable phrases come in colloquial speech. Therefore, only electronic dictionaries, which can be updated quickly, are able to provide the user with all the necessary and complete information. Thus, a modern dictionary should have the following features:

1. Quite a large volume vocabulary.
2. Ensure consistent retrieval of information depending on the user's needs.
3. Provide complete grammatical information about the words of the input and output languages and material on proper names with transcription programs.
4. Provide the user with all necessary audio, graphic and multimedia capabilities.

Obviously, only electronic dictionaries can meet all the above mentioned requirements.

**A brief overview of existing electronic dictionaries.** A large number of electronic dictionaries have released currently. For example, one of the most complete and most popular in our country automatic online dictionaries: Multitran (developer Andrey Pominov) [4]. Multitran database, as well as the majority of databases such dictionaries, is created by scanning, recognition and processing of a large number of paper dictionaries and combining the received word translations into a single database. The most fully represented parts of the dictionary are the English-Russian-English, German-Russian-German and French-Russian-French. The least complete – Kalmyk-Russian-Kalmyk. In addition to the Internet version, an offline version of Multitran is in access. It is compatible with Microsoft Windows, Pocket PC, Symbian, Linux operating systems. The dictionary has more than 800 subject areas and has the ability to actively self-completion by users. Multitran is technologically close to the dictionary <http://dict.leo.org>, where each translation is a hyperlink to obtain a reverse translation, while most other dictionary sites offer translations in continuous formatted text.

Another popular electronic resource is MultyLex [5]. It is created by MediaLingua in 2010 as a digital copy of the «New big English-Russian dictionary» edited by A. D. Apresyan. The purpose of this approach is the correct translation of the traditional paper dictionary into an electronic form for Windows XP, Windows 7, Windows Vista.

The main advantage of MultyLex is a built-in sound synthesizer. However, it is dangerous to fully trust such an approach without controlling it by transcription. The synthesizer may not be able to put an accent or distort the pronunciation of a word. There is also an expanded version of the MultyLex. Economic and financial, law, construction, polytechnic and polygraphic dictionaries are added to the main dictionary.

The main drawback of the MultyLex is a serious backwardness of each version from the language reality, as a rule, not less than ten years. The strict binding of the MultyLex to the paper prototype does not make it possible to correct and

supplement the electronic dictionary online. It is also impossible to change the structure of the dictionary entry.

Since English is the main language of the Internet, the vast majority of reference books are English dictionaries, represented by monolingual, bilingual and multilingual versions. Sources can be found in the catalogues of electronic dictionaries at many addresses. The most reliable are <http://www.dictionary.com>, <http://www.oz.net/~mev/wg/dictionary>, <http://www.internetoracle.com/dictiona.htm>, <http://www.councilsales.com/lists/dictionaries>, <http://www.brown.edu/Department/Cog/Ling/Sci/lingdir/dictionary> [6].

It is interesting to note that today many researchers trust special dictionaries that register and process certain terminological groups of vocabulary. They are terminological dictionaries or dictionaries of sublanguages, such as Tropical Medicine Glossary [7], Management and Technology Dictionary [8].

Taking into account all the above factors, the 2<sup>nd</sup> English Department together with the Department of Software for Information Systems and Technologies began to develop the electronic English-Belarusian-Russian dictionary of technical terms. The pilot version of the dictionary is named TechLex and covers the following subject areas: architecture and construction, water supply, information technologies, pedagogy, transport communications, economics and energy supply.

**Main design principles.** In the process of English-Belarusian-Russian technical dictionary development, a client-server application was developed. It is compiled in the Java programming language on the base of the architectural pattern MVC (Model-View-Controller). The General architecture of the application is shown in Fig. 1.

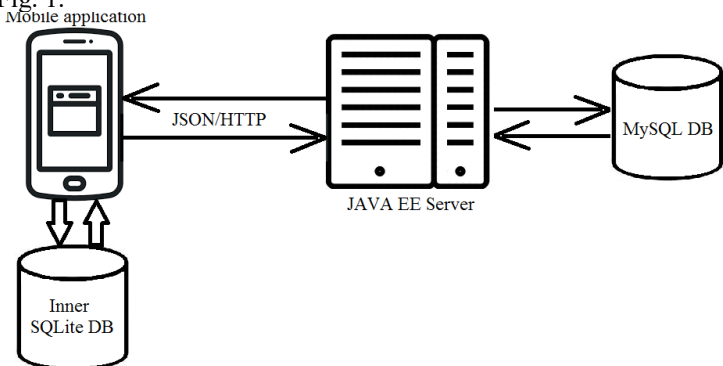


Fig. 1. General architecture of the application

The server part of the developed system contains a MySQL database (DB) and JAVA EE server that operates with TomCat servlet container. The client part of

the system contains SQLite database and a mobile application for Android operating system. To create and design a mobile application the standard tools of Android Studio development environment were used.

A separate table with a surrogate primary key in the form of id column was created for each subject area in the dictionary database. There are no relationships between the tables because this is not necessary. This structure allows a user to easily update the database in the mobile application, because when new words are added to the server, only the actual table will be updated without irrational downloading of all subject areas of the dictionary.

Currently, each subject area of TechLex dictionary contains about 10,000 terms. Since several teachers are working on the linguistic support of the proposed electronic dictionary at the same time, it was decided to place the word table in the Internet in Google table. This approach allows you to quickly enter words, check them and export the latest version to the application database. A fragment of the technical terms for the information technology subject area is shown in Fig. 2.

	A	B	C	D	E	F	G	H	I	J
293	292	production code	программный код	программный код						
294	293	program icon	дисконд	дисконд						
295	294	programming language	язык программирования	язык программирования						
296	295	Programing Software	ПО для программирования	ПО для программирования						
297	296	Progress Window	окно, показывающее процесс загрузки	окно отображающее процесс загрузки						
298	297	Project Management (Software)	ПО управления проектами	ПО управления проектами						
299	298	server window	окно сервера	локальный сервер						
300	299	PS/2 connector	с 2-хпиновый разъем PS/2	2-хпиновый разъем PS/2						
301	300	public class	открытый класс	открытый класс						
302	301	public static void	методы класса	методы класса						
303	302	purchase	предварительная покупка	предварительная покупка						
304	303	random access memory (RAM)	память с случайным выбором	память с произвольной выборкой						
305	304	random number generator	генератор псевдослучайных чисел	генератор псевдослучайных чисел						
306	305	random access device address	адрес для чтения/записи в устройстве с доступом к данным	адрес для чтения/записи в устройстве с произвольным доступом						
307	306	random access	случайный доступ	произвольный доступ						
308	307	readable text	читаемый текст	удобочитаемый текст						
309	308	read only memory (ROM)	неизменяемая память	неизменяемая память						
310	309	real database	реальная база данных	реальная база данных						
311	310	real-world unit test	реальный/практический тест	реальный/практический тест						
312	311	record	запись	запись						
313	312	reactive table	реактивная таблица	реактивная таблица						
314	313	refactor	перефакторизовать	перефакторизовать						
315	314	Registry	система реестр	Системный Реестр						
316	315	reference	ссылка	ссылка						
317	316	relational data model	реляционная модель данных	реляционная модель данных						
318	317	relational database	реляционная база данных	реляционная база данных						

Fig. 2. A fragment of the technical terms in TechLex

**3. The research results.** The developed mobile application for the English-Belarusian-Russian dictionary of technical terms TechLex was tested for the Android operating system on tablets and smartphones with different screen diagonals. To work with TechLex dictionary a user should firstly select the original language of a technical term and a translation language. The user can choose from the English, Belarusian and Russian languages in both directions. By default,

English-Belarusian translations are set. Next, you need to select the subject area from the above ones, enter a desired word in the search box and confirm the action. After that, the term translation will appear in the results field. Flipping through the other subject areas, the user can find other translations of the term, because a sufficiently large number of words are polysemantic.

It should also be noted that the selected subject area is saved for future searches, because the user usually works with it. In Fig. 3 the screen copies of the dictionary mobile application are shown. They demonstrate the examples of technical terms searching. So the left copy of the screen demonstrates the translation of *rain rills* in *transport communications* area from English into Belarusian. The central copy of the screen shows all phrases that are reproduced for the term *random* while the translation from English into Belarusian in *information technologies* subject area. Fig. 2 represents the fragment with the translation of these words (lines 304 – 307). The right screen copy in Fig. 3 shows the ability to select the language of translation and displays all the words of the English language from *construction and architecture* subject area. The application has all selected Belarusian translations that begin with the letter *a* or have it in their composition.

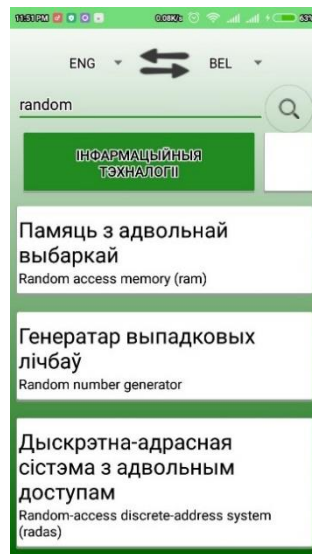




Fig. 3. The screen copies of the dictionary mobile application

**Conclusion.** The software of our English-Belarusian-Russian electronic technical dictionary is designed taking into account the analysis of modern electronic multilingual translation dictionaries and has a number of advantages:

1. This is the first technical multilingual electronic dictionary with an English-Belarusian-Russian version.
2. The interface of the electronic dictionary is designed in such a way that only a single zone is activated in accordance with the user request, so there is no need to view all the subject areas of the dictionary.
3. The linguistic database of the dictionary is compiled not by the traditional method of processing a large number of paper dictionaries and combining the translations. It is composed by the sequential processing of scientific and technical English periodicals of above mentioned subject areas.

The material for investigation was taken from the English periodicals «Architects Journal», «Architectural Digest», «Canadian Journal of Civil Engineering», «Journal of Civil & Environmental Engineering», «Applied Economic Prospects and Policies», «Economic Development and Cultural Changes», «Journal of Financial Economics», «Civil Engineering Journal», «International Journal of Energy», «Energy & Environment».

Currently, the web application of the TechLex electronic dictionary is being

developed. It will be placed in the local network of the Belarusian National Technical University to be in open access for all university students and academic staff.

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### ПРОГРАММНОЕ ОБЕСПЕЧЕНИЕ ДЛЯ РАСПОЗНАВАНИЯ ТЕКСТА С ПЕРЕВОДОМ НА ИНОСТРАННЫЕ ЯЗЫКИ

Доклад посвящен проблеме создания программного обеспечения для распознавания русскоязычного текста с последующим переводом на английский язык. Авторы предлагают использование искусственных нейронных сетей для распознавания текста. Для программной реализации рассмотрены библиотеки, реализующие метод обратного распространения ошибки при работе с искусственными нейронными сетями. Программное обеспечение работает под управлением операционной системы Андроид и предназначено для мобильных устройств.

**Ключевые слова:** *электронный переводчик, приложение-переводчик, приложение-словарь, распознавание текста, программа-переводчик на иностранные языки.*

**Введение.** Принято считать, что мировая история машинного перевода началась с развитием компьютеров, однако идея создания механизма, способного осуществлять перевод текста с одного языка на другой,