ABSTRACT AND REFERENCES

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DEVELOPMENT OF MODELS FOR THE FORMALIZED DESCRIPTION OF MODULAR E-LEARNING SYSTEMS FOR THE PROBLEMS ON PROVIDING ERGONOMIC QUALITY OF HUMAN-COMPUTER INTERACTION (p. 4-13)

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A complex of the systems models of e-learning, necessary for the provision of ergonomic quality, was developed. Relevance of this development is determined by a wide propagation of electronic learning technologies and insufficient level of their effectiveness, which is mainly defined by the existence of means of ergonomic quality management. It was established that, if we describe software and hardware learning means, electronic learning modules, humans-operators, means of ergonomic provision, implied in the system of dialogue interaction technology relying on a totality of component and morphological structures, it will be possible to formulate requirements for the system of e-learning data and knowledge bases.

A standard structure of component and morphological models for e-learning was formed. It was shown that the application of such models provides the e-learning adaptive capacity, and as a consequence, higher quality of human-computer interaction. The development may be useful for the formation of systems of information support of e-learning and provide essential enhancement of working conditions and motivation of people, trained in information learning environments of secondary educational institutions, universities, enterprises, firms, etc.

Keywords: e-learning, ergonomics, "human-technology-environment", systems analysis, electronic learning module.

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DEVELOPMENT OF A METHOD FOR DETERMINING THE KEYWORDS IN THE SLAVIC LANGUAGE TEXTS BASED ON THE TECHNOLOGY OF WEB MINING (p. 14-23)

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The authors accomplished the task of development of algorithmic support of processes of the content monitoring for solving the problem of defining the keywords of a Slavic language text based on Web Mining technology. Substantiation of peculiarities of its use for defining keywords and subject heading of the text content was considered. Web Mining technology allows us to take advantage of the text content monitoring method based on the Porter's stemmer to solve the problem on determining the keywords. Stemming modification is based on the well-known classification of morpheme and word formation structure of derivatives of the Ukrainian language, revealing patterns of affixes combination, modeling the structural organization of verbs and suffixed nouns. Algorithms of morphonological modifications in the process of verb word changing and adjective word changing and word formation in the Ukrainian language were used. Decomposition of the method of determining keywords of the text content was performed. Its features include adaptation of morphological and syntactic analysis of lexical units to peculiarities of Ukrainian words/text structures. Algorithm sup-

port of its main structural components was developed. Its features include convolution and analysis of a nominal/verb group and construction of appropriate trees of analysis for each sentence, taking into account the features of their structures as elements of the Slavic language texts. The formal approach to the implementation of stemming of a Ukrainian language text was proposed. It is aimed at automatic detection of notional keywords of a Ukrainian text due to the proposed formal approach to implementation of stemming for the Ukrainian language content. Theoretically, the ways of enhancing efficiency of the keywords search, in particular their density in the text, were found. They are based on an analysis of not the words themselves (nouns, a set of nouns, adjectives with nouns, other parts of speech are ignored), but rather of word stems in Slavic language texts. The rules of stem separations in texts consider not only the isolation of inflexions, but also suffixes, as well as registering the letter alternation during declension of nouns and adjectives. Based on the developed software, we received the results of experimental testing of the proposed content monitoring method for defining keywords in Slavic language scientific texts of technical area based on the Web Mining technology. It was found that for the selected experimental base of 100 works, the best results according to density criterion are achieved by the method of article analysis without compulsory initial information and a list of literature. This is attained through training the system and by checking the refined blocked words and refined thematic dictionary. It was also discovered that for technical scientific texts of the experimental base, the best results are reached by the method of article analysis without beginning (title, authors, UDC, abstracts in two languages, author's keywords in two languages, work place of authors) and without a list of literature with the check of specified blocked words and refined thematic dictionary – for it the average value of keywords density in the text reaches 0.34, which is by 81 % higher than the correspondent value of density of the original text, which makes 0.19. By numerous data of statistical analysis, it was proved that setting parameters of the system increases the number of defined keywords almost by 2 times without decreasing the indicator of accuracy and reliability. Testing of the proposed method for determining keywords from other categories of texts, such as scientific humanitarian, fiction, journalistic, require further experimental research.

Keywords: Web Mining, NLP, content, content monitoring, keywords, content analysis, Porter stemmer, linguistic analysis.

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IMPLEMENTATION OF THE SIMPLIFIED COMMUNICATION MECHANISM IN THE CLOUD OF HIGH PERFORMANCE COMPUTATIONS (p. 24-32)

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Constructing a system with traditional resources, based on the concept of high-performance computations (HPC) and data processing in the cloud, fully reveals new addressing problems. In the course of processing the data, it discovers many other unexplored scientific problems. One of these problems is to reduce the network expenditures on a virtual cluster in the cloud with HPC. In order

to solve this problem, the work presented proposes a mechanism of simplified communication (SCM) to optimize the intra-cluster network performance, which intercepts packets at the level below that of network, and verifies whether it is meant for a coresident virtual machine. Compared with TCP, the introduced protocol of simplified communication (SCP) makes it possible to avoid the slow start phase, and to use a smaller header for a data packet, which improves the intra-domain and extra-domain throughput. To implement SCM inside the system, we also integrated XenLoop. A dispatched packet is sent through the FIFO channel, which is opened by XenLoop. This realization supports binary compatibility for the applications that use a standard socket interface. Throughput of the intra-domain communication in the system with SCM improves by about one and a half, while relative time of a reference test with a set of NAS-tags is lower. Experimental comparison of indicators for SCP and a protocol of remote memory access (RMAP) shows that SCP is 7.8–7.9 % faster than RMAP.

Keywords: mechanism of simplified communication, high-performance data processing, binary compatibility, cluster.

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DEVELOPMENT AND USE OF A GEOINFORMATION SYSTEM FOR REVEALING URBAN PROBLEMS (p. 32-41)

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The study of urban processes in East Europe has revealed contradictions in the development of urban areas and some negative trends in the transformations of urban space. These trends significantly degrade the performance of functions by an urban area. To assess the extent of the problem, data were collected on the condition, primary purpose and functions of urban space objects at several test sites. Further research on these imbalances has revealed the need to create a specialized geographic information system. Consultations, surveys in the bodies of city administration and a review of existing publications have helped determine the requirements for such a GIS and its potential for commercialization.

In this study, a new concept is suggested and an alpha geographic information system is devised to manage urban development. Its functionality also allows determining the factors that lead to negative transformations of urban space and defining the characteristics of such phenomena. This geographic system is positioned not as a decision support system for city authorities and local communities. It differs from similar systems as its features focus on detecting a problem and determining controversy in a particular area. It is graphically presented in terms of its structure as well as its information and function contents. A possible name suggested for such a geographic information system can be "A Smart City" as

this geosystem is designed to improve the performance of functions by urban areas.

The tests of the software package on the test areas have identified zones with typical urban processes: gentrification, commercialization, and revitalization. The research results are presented for illustrative purposes in a cartographic form.

Keywords: geographic information system, urban studies, smart city, spatial transformation, urban space, gentrification, commercialization, revitalization, map.

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DEVELOPMENT OF INFORMATION TECHNOLOGY FOR THE GENERATION AND MAINTENANCE OF KNOWLEDGE–ORIENTED CONTROL SYSTEMS (p. 41-49)

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Based on the analysis of existing solutions in the field of control and knowledge-oriented systems, it was concluded that the use of knowledge is expedient for automating analysis of the object states. Actual is automation of the stage of structuring knowledge for control. As a model of knowledge presentation, it was suggested to use rules. To display control rules, their interactive processing and analysis, the rules models in the form of AND/OR graph and Boolean expressions applied in checking rules were improved. An IT was proposed using a rule editor to develop knowledge-oriented control systems based on the developed models and methods and on the need of partial shift of the stage of knowledge testing to earlier stages of development. With the help of IT and the rule editor, working prototypes have been developed. The ES for dispatchers regulating safe performance of works with electrical installations has enabled a 12 % increase in validity of the decisions made by dispatchers.

Keywords: knowledge-oriented control technology, model of control rules, AND/OR graph, expert control systems.

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DEVELOPMENT OF SPECIALIZED SERVICES FOR PREDICTING THE BUSINESS ACTIVITY INDICATORS BASED ON MICRO–SERVICE ARCHITECTURE (p. 50-55)

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The proposed mathematical model of specialized services for the prediction of arbitrary indicators of company activity is presented as a part of the micro-service architecture of the information system of an enterprise and provides dynamic replacement or addition of the prediction models without changing the overall algorithm of service operation. This model assigns a formal basis for the intra-component interaction of the service and makes it possible to change, add, and delete prediction services without the need for resetting the information environment of a company.

The prediction model was proposed as a part of the prediction service of the company IS, based on neural network with the embedded model of moving average. This model allowed improvement of quality of predictive assessment in the case of existence of a trend in comparison with the classical neural network model due to the embedded model of moving average.

The algorithm was developed for training a neural network forecasting model with the embedded moving average model, based on the inverse error spread, which allows us to tune the model to the examined time series.

We considered practical aspects of using a specialized prediction service, a client application to this service, which clearly demonstrates its functionality under the mode of checking appropriateness of using a certain prediction model on a specific type of preset data.

Keywords: information systems, forecasting models, micro-service architecture, neural networks, distributed objects.

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DESIGN OF PRECISE CONTROL SYSTEMS OF INDUSTRIAL PLANTS (p. 56-62)

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The research is conducted due to the need to modernize automated control systems of continuous industrial processes, improve their accuracy and quality. The approach to the design of precise control system is developed. The approach is based on a set of models. Based on the known analytical relationships, the mathematical model of the dynamics of a nonlinear control object is developed. Its feature is a full accounting of the kinetics and thermodynamics of the first-order chemical reaction. The model for direct determination of the hydraulic friction coefficient, based on the approximation of the Colebrook-White nomogram is developed. The model of the valve hydrodynamics, depending on the opening rate and flow velocity is developed. The models of automation hardware, considering characteristics, errors and dynamics are developed.

The optimal multivariable controller on the basis of the theory of analytical design of controllers is designed. The proportional - integral action of the controller is formed by the extension of the object model. A full measurement of the object states made it possible to abandon the use of a state observer.

The precise automated control system of the vitamin B_6 synthesis reactor is developed. The transients resulting from the automated control system modeling demonstrate deviations of the controlled plant parameters from the nominal value: concentration – no more than 5 %, temperature – no more than 2.5 %, and level – within 2 % under significant disturbances in feedstock consumption rates at the reactor input (20–30 %). Due to small deviations of transients under the action of disturbances, the proposed precise automated control system ensures the high quality of the product and the process safety in the reactor. The developed approach is recommended for use in the design of precise control systems, and the designed precise automated control system of the vitamin B_6 production reactor – in the pharmaceutical industry.

Keywords: precise automated control system, reactor, vitamin B_6, nonlinear mathematical model.

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