ABSTRACT AND REFERENCES

INFORMATION TECHNOLOGY. INDUSTRY CONTROL SYSTEMS

DOI: 10.15587/1729-4061.2017.90506

DESIGNING A DECISION SUPPORT SYSTEM FOR THE WEAKLY FORMALIZED PROBLEMS IN THE PROVISION OF CYBERSECURITY (p. 4-15)

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We devised a decision support system (DSS) for the weakly formalized problems of information protection and the provision of cybersecurity at the informatization objects. The system is based on the models that describe the tasks of information safety and cyberprotection in the conceptual and functional aspects. We described the process of compiling a knowledge base of DSS for the circumstances related to the detection of hard-to-explain attributes of anomalies and attacks. The DSS "Decision Support System of Management protection of information – DMSSCIS", which we designed, makes it possible to improve understanding of the analyzed situations that occur in the process of cyberprotection of mission critical computer systems. While tested at the enterprises, it was established that the "DMSSCIS" system enabled effective visualization and interpretation of results of current assessment of the revealed hard-to-explain attributes of anomalies and cyberattacks, as well as allowed us to describe current situation in the course of multistage targeted cyberattacks. It was established that the application of DSS "DMSSCIS" in the interaction with other systems for the intelligent recognition of illegitimate interference in the computer systems operations made it possible to improve efficiency of decision making on information security. While testing, it was found that the application of the "DMSSCIS" system allowed reducing the time required to inform persons, responsible for cybersecurity, about the incidents by 6.9–7.2 times.

Keywords: decision support system, cybersecurity, weakly formalized problems, interpretation of situation.

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DOI: 10.15587/1729-4061.2017.92021

DEVELOPMENT OF KNOWLEDGEORIENTED SYSTEM OF MACHINE TRANSLATION BASED ON THE ANALYTICSYNTHETIC TEXT PROCESSING (p. 15-24)

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A method for automated syntactic text analysis based on the declarative representation of the rules of syntactic combinability was developed. In this method, in contrast to those existing, the tables of syntactic rules are used not only for the context analysis, but also for defining the subject, predicate, secondary parts of the sentence, as well as superphrase syntactic combinations.

A method for software distribution of analytical-synthetic processing of a natural language text in machine translation systems was developed. The developed method, in contrast to the known methods, takes into account conditions of transition to parallel data processing both at the level of processing tasks and depending on the data type.

The C# applications, where the developed methods for analytical-synthetic processing of multilingual Russian, Ukrainian and English texts were realized, were implemented by software. It was experimentally proved that the developed software for texts on military subject area allow reducing the number of errors of semantic character by 14–16 % in comparison with the existing machine translation systems through the automated text processing at the level of sign system and the introduction of super-phrase synthesis.

Keywords: machine translation system, automated text analysis, analytical-synthetic text processing.

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DOI: 10.15587/1729-4061.2017.92815

USE OF ONTOLOGIES AND THE SEMANTIC WEB FOR QUALIFICATIONS FRAMEWORK TRANSPARENCY (p. 25-31)

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The problem of correlating and comparing the levels of the European and national qualifications framework and the potential of the Semantic Web technologies for solving this problem were explored. We substantiated the need for creating models and methods, aimed at providing transparency of the European and national qualifications frameworks and the development of tools for implementing these methods.

Authors proposed a reference model of the qualifications framework that formalizes knowledge of basic information objects relating to learning outcomes and their representation in the qualifications frameworks. The specific feature of this model implies using atomic competencies: semantics of information objects of different classes is formalized through the set of such atomic competences that are associated with different properties of these objects. This should provide for the automatic matching of these information objects on the level of knowledge. The methods of quantitative estimation of semantic proximity between information objects of different classes of ontological models, which corresponds to different problems, are proposed in the work. This allows identifying a similarity between learning outcomes, which are described with the use of descriptors of different qualification frameworks.

Information regarding atomic competences is obtained from the national and European standards, qualifications frameworks, speciality descriptions, etc. They may be automatically supplemented via analysis of relevant information of Web-resources that contain semantic markup.

The work considers in detail the mechanism of integration of the reference information model of competences with technological environment Semantic MediaWiki: ontological concepts and relations are used for semantic markup of Wiki-pages by categories and semantic properties. This allows running a variety of semantic queries to the content of pages, relating to learning outcomes. Examples of such queries are given and their expressive power is analyzed.

An example of using the ontological model of competences for improving semantic Web-search for the information for the purpose of supplementing and updating Wiki-pages was studied. The ontology potential in specification of information needs and the increased intersection of the obtained results is demonstrated with the example of the semantic search engine MAIPS.

Keywords: qualifications framework, ontology of competences, Wiki, semantic markup, semantic search.

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DOI: 10.15587/1729-4061.2017.91271

THE SCHEDULER FOR THE GRIDSYSTEM BASED ON THE PARAMETERS MONITORING OF THE COMPUTER COMPONENTS (p. 31-39)

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The structure of the centralized distributed computer system (DCS) task scheduler, which uses the adaptive resource security management mechanism was developed. By interacting with local agents of the given compute nodes, the scheduler defines the system node parameters and selects the resources with the specified security and performance requirements. Ensuring an optimum combination of mutually exclusive security and performance parameters is a non-trivial task, requiring the development of new approaches to solving it.

The research found that the adaptive distributed system resource security management mechanism increases the DCS performance in comparison with the classical resource security management mechanism. In particular, the research shows that the average task time in the queue and the average task time in the system with the adaptive security level management mechanism is 2.8 and 2.1 times lower, respectively, in comparison with the classical security level management mechanism. At the same time, the adaptive security management introduction requires additional software on the DCS compute nodes for the CN status parameters monitoring. The experiments demonstrate that the monitoring system can significantly reduce the DCS performance. Thus, according to the experiments, in case of 25 % load on the DCS CN from the monitoring system, the average task time in the queue and the average task time in the system increase by 62 % compared with a situation where monitoring is not performed.

The research results need to be considered when introducing the secure data processing mechanisms in DCS to prevent a substantial decrease in the distributed system performance.

Keywords: distributed computer system, computing resource management, task scheduling, compute node parameters monitoring.

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DOI: 10.15587/1729-4061.2017.92831

DEVELOPMENT OF MODELS AND MEANS OF THE SERVER PART OF THE SYSTEM FOR PASSENGER TRAFFIC REGISTRATION OF PUBLIC TRANSPORT IN THE "SMART" CITY (p. 40-47)

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We built a structure of the server part of the system for passenger traffic registration of city public transport. The developed structure is based on a module principle, which provides simple and fast replacement of particular module in case of its failure. As a result, improved reliability of the system as a whole is achieved, as well as smooth scaling and an increase in the system capacity in future. The algorithm of functioning of the server part of the system for passenger traffic registration of city public transport is developed. Its features are the use of systemic approach to the implementation of incoming data processing and the automation of work of the human-machine system. This made it possible to check correctness of the initial processed data and clearly represent results of calculation of passenger traffic parameters. We developed and implemented specialized software for the server part of the system for passenger traffic registration of public transport. The software is based on the three-level model and implements all the above-mentioned features of the device. Specialized software employs modern approaches of object-oriented programming, including the use of Web frameworks. An information model is developed that ensures reliable data exchange between a client and a server of the system. The model includes a range of modern technologies and protocols. These technologies include video data collection using IP cameras, data transfer with the help of 3G, storing them in a relational DB and on disk space of FTP Server, data processing using the list data structures and storing of statistics in the form of XML files. Accordingly, the developed software is based on the application of modern protocols for the collection, transmission, processing and storage of data (TCP/IP, MySQL Client/Server Protocol, HTTP, FTP, etc.). The technologies and protocols applied allow us to effectively organize the transfer and processing of incoming video, photo- and text data.

We developed and implemented technical provision of the server part of the system for passenger traffic registration of public transport. This product provides low cost of technical solution and is based on the use of low-cost components that ensure reliable operation of the system in full.

Results of using developed system are presented, in particular: reports that are generated using the developed system that reflect a full picture of the passenger traffic along the vehicle route. The designed and developed system for passenger traffic registration of public transport is verified at ATP "Mens-Auto" and "Etalon" in the city of Ternopil (Ukraine). Obtained data allow us to state that the system operates properly and correctly.

Keywords: "smart" city, system for passenger traffic registration of public transport, information and software models.

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DOI: 10.15587/1729-4061.2017.90655

COMPUTERINTEGRATED TECHNOLOGY FOR THE EARLY DETECTION OF BREACHES IN THE BOREHOLE WALLS STABILITY IN THE DRILLING PROCESS (p. 48-55)

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We substantiated and examined computer-integrated technology for the early detection of breaches in the stability of walls of a borehole based on the knowledge base of clear rules that allow operating the sets of input technological parameters and preventing emergencies.

A formal mechanism is proposed for supporting the decision-making process in real time based on the operation with logic functions to detect breaches in the stability of walls of a borehole. This makes it possible to directly operate with the developed clear logic structure and information on the current values of controlled factors and to provide intelligent support for the process of decision-making when establishing governing values for the controlled parameters of a technological process. A basis of the devised formal mechanism is the model that is presented in the normal disjunctive form. It provides for a high level of analysis of the current input information and the formation of decision on the breach of stability of the walls of a borehole with the loss of circulation.

We realized the scheme of logic device (finite automaton), designed for the early detection of breach in the stability of walls of a borehole in the process of drilling oil and gas boreholes, which is based on logic function and the Veitch-Karnaugh methods. The designed device, based on the current information about the factors of drilling process, generates optimal decision regarding early detection of breach in the stability of walls of a borehole.

Keywords: automatic detection, stability of the walls of a borehole, drilling, Veitch-Karnaugh diagrams.

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DOI: 10.15587/1729-4061.2017.93335

DEVELOPMENT OF AUTOOSCILLATING SYSTEM OF VIBRATION FREQUENCY SENSORS WITH MECHANICAL RESONATOR (p. 56-60)

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At present, resonator sensors with an auto-oscillating system have a number of advantages in comparison with the known sensors with frequency output. In this case, developed auto-oscillating systems of resonator sensors are very specific; their elements are oriented toward a particular type of resonator and possess a certain degree of nonlinearity, which makes studying and modeling such systems impossible.

In the present work, analytical expressions were obtained for the reduction of parameters of mechanical systems of resonators to the lumped ones. This allowed us to apply the methods of research into nonlinear systems of control to the analysis of AOS and to receive the expression of transfer function of nonlinear resonator with consideration to the nonisochronicity. A structure of auto-oscillating system with a nonlinear resonator is devised, which was not explored earlier.

With the purpose of selecting the character of nonlinearity in the elements of feedback and mechanical resonator of the assigned type in AOS to warrant the assigned stability of frequency and amplitude of auto-oscillations, we performed imitation simulation in the Matlab Simulink programming environment.

The simulation demonstrated that a nonlinear amplifier at work with a nonlinear mechanical resonator provide for the auto-oscillating system that is stable by frequency and amplitude. Thus, auto-oscillating system of the devised structure can be used in the design of vibration frequency sensors.

Keywords: vibration frequency sensor, auto-oscillating system, nonlinear amplifier, analytical stability criterion.

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