

ABSTRACT AND REFERENCES

INFORMATION AND CONTROLLING SYSTEM

ANALYSIS OF A NEW MODEL OF LOW ENERGY ADAPTIVE CLUSTERING HIERARCHY PROTOCOL IN THE WIRELESS SENSOR NETWORK (p. 4-8)

Volodymyr Mosorov, Sebastian Biedron, Taras Panskyi

Wireless sensor networks constitute a special group of distributed measurement systems that are increasingly used to observe environmental factors for civilian or military purposes. These observations are not conducted by a single node, but rather by multiple nodes which together form ad-hoc cooperation networks. The event to be measured can be observed with the benefit of the very working principle of sensor networks, where information from each node is transmitted to the observer in the form of an induced periodic query or is induced by the event. With the technological advancements it is now possible to manufacture nodes whose size is in the order of centimeters. This enables the use of sensor nodes on an unprecedented scale and opens new opportunities for so-called ubiquitous computing. Initially, sensor networks were wired solutions. The development of wireless and data processing technologies has helped sensor nodes to take over a larger area of research. The authors of this article wish to raise the issue of sensor networks development and show the influence of various factors on the self-positioning of sensor networks.

Keywords: Wireless sensor network, LEACH, self-organization protocols, node, cluster tree.

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A SOFTWARE AND HARDWARE SYSTEM FOR STUDYING THE FUNCTION OF OSTIOMEATAL COMPLEX (p. 9-13)

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Numerous studies are devoted to the behavior of pressure in the maxillary sinus, although most of the researchers focus on the patency of the maxillary junction in identifying the indications for surgery or in measuring the dynamics of treatment. In all cases, characteristics of the pressure in the maxillary sinus were recorded with standard rhinomanometric equipment as well as rhinometric, sinusmetric and pneumometric devices.

Within recent years, researchers have improved technical tools for high-accuracy recording of biomedical signals, which allows a new-level study of the dynamics of air pressure in the maxillary sinus.

The paper presents a hardware and software system for researching the function of ostiomeatal complex. The system provides simultaneous measurement of differential pressure signals in the maxillary sinus and the nasal cavity, which ensures an objective assessment of the maxillary sinus function and ostiomeatal complex structures. Accuracy of the measurements is assessed through calculation of uncertainty, whereas the method of reduction improves reliability of indirect correlated measurements and veracity of the uncertainty assessment. The devised approach can improve the efficiency of diagnosing ENT diseases.

Keywords: differential pressure, ostiomeatal complex, expanded uncertainty.

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ANALYSIS OF THE MODIFIED ALTERNATIVE DECISION RULE IN THE PRECLUSTERING ALGORITHM (p. 13-18)

Volodymyr Mosorov, Taras Panskyi, Sebastian Biedron

The preclustering algorithm as opposed to other existed algorithms does not require a priori information about cluster location and about additional means of control. Preclustering algorithm is multipurpose and promising for a primary analysis of investigated input data. In this article the main part of the preclustering algorithm – the modified decision rule has been presented. The modification consisted in the replacement of the calculation of mean distances in a precluster (like in the classical decision rule) by the mean distances from the center of the precluster to all objects in the chosen precluster. The proposed decision rule determines the centre of the group as a local density maximum of the group of objects (before clustering) or of the precluster (after clustering). The results obtained during the testing of the decision rule were compared with the results obtained with the use of criteria of spherical resolution. Also, from the analysis, the advantages and disadvantages of the proposed decision rule have been identified.

Keywords: preclustering algorithm, precluster, modified decision rule, validity criteria, cluster.

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DEVISING AN INFORMATION SYSTEM FOR THE ANALYSIS OF PULSE SIGNALS (p. 19-23)

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Technical information systems for medical purposes would intensify the diagnosis, prognosis and authentication of the patient's condition, creating the possibility of computer modeling and simulation experiments. It is suggested that criteria for the analysis of a pulsogram at long time intervals be obtained with the methods and tools of fractal analysis that allow detecting self-similarity and consistency of a long-interval sequence. Quantitative description of a long-interval pulsogram was aided by the method of phase plane. First of all, the method is effective since any change in the heart rhythm and any dysfunction in the CVS are reflected both in the sequence of periods and in the rate of their change over time.

We experimentally used model data in identifying criteria for the pulsogram analysis by the phase portraits and applied the statistical analysis of variance in assessing the samples of model data. Analysis of the samples showed that criteria of the pulsogram analysis based on phase portraits can be represented by the following characteristics of the phase portraits pulsogram: the degree of chaotization, the area, and the fractal dimension as the largest diameter of the phase portrait. The outcome of the research is six sets, each containing an array of values of the analysis criteria, i.e. numerical performance characteristics of the phase portraits pulsogram.

The suggested algorithm of the information system for the pulsogram analysis allows distinguishing various pulsograms due to the type of pulse when its criteria of the analysis fall into a certain functional set and identifying the presence/absence of a pathology in the cardiovascular system due to the type of pulse.

Keywords: information system, analysis criteria, pulse signal, pulse, phase plane, phase portrait.

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DEVELOPMENT OF A STOPPING RULE OF CLUSTERING PERFORMANCE BY USING THE CONNECTED ACYCLIC GRAPH (p. 24-30)

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In this article the technique of the analysis of a stopping rule for the data preclustering algorithm without the prior information about the number of clusters with the use of a connected acyclic graph is introduced. The connected acyclic graph (tree) makes it possible to represent the interconnection between the objects in input data. The stopping rule allows a halt at the some step assuming that further clusterization will not cause finding new clusters. The core of the analysis was the application of the preclustering algorithm and the stopping rule to the series of input data which were represented by sample cases of input data. Sample cases were input data with normal distribution law which belonged either to a single group or to many groups. The analysis has shown the advantages of the stopping rule for the data preclustering algorithm.

Keywords: initial clustering, preclustering algorithm, stopping rule, connected acyclic graph, cluster.

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IDENTIFICATION OF MEDICOBIOLOGICAL PARAMETERS SYSTEM OF CLINICAL MONITORING FOR FAMILY MEDICINE (p. 31-36)

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The paper examines the problems associated with collecting and processing the data on medico-biological parameters of patients.

These problems are considered in terms of solving the problem of clinical monitoring. Implementing the clinical monitoring process suggests that a family doctor should have modern diagnostic equipment. Such equipment can collect primary medical data and transmit them to the server side for the automated processing.

Health Grid infrastructure technologies enable distributed data processing of a large number of patients. These patients may relate to different doctors from different medical institutions. Such an approach allows to collect a large amount of statistical data that can be used for the individual needs of a certain patient and comprehensive epidemiological analysis in the country or in a particular area. The open e-Health architecture platform ensures the operation of sensors that collect medical data of patients during clinical monitoring. These data can be transmitted via a wired or wireless connection to the microcontroller and the server. Processed data from many patients allow to build intelligent algorithms that detect dependencies between the values of medico-biological parameters and diagnosis. In addition, various medical research data can be collected from the web space. These two types of data can be used for developing collaborative recommendation systems. Such systems are some kind of decision support systems that provide family doctors with the possible options of diagnoses and useful recommendations in a convenient form and with a given level of reliability and accuracy.

Keywords: clinical monitoring, diagnostic device, Health Grid, e-Health architecture, identification, medico-biological parameters.

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ANALYSIS OF AN ACTIVE FINGERPRINTING APPLICATION OF THE TRANSPORT LAYER OF TCP/IP STACK FOR REMOTE OS DETECTION (p. 36-45)

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Looking out for number of formed new operating systems and their quality we can clearly say that the cybercrime era is only just beginning. Developers are more interested in an early release of a new product than proper protection of the previously existing one, which implies a negligible “incorrect” implementation of TCP/IP stack. Future releases of the operating system usually have the same irregularities and frequently there are new irregularities in the behavior of the system on at the carried out standard scans. Summarizing, incensement of the interest in active Fingerprinting of the transport layer of TCP/IP stack have been the objective of this paper. Out of all the layers of protocols, we can conclude that the TCP due to the many unused functionality in its construction constitutes quite large source on the basis of which the device can be clearly identified by the scan. In this paper a different tests have been presented, namely: Flag probing, Window size probing, Time of Retransmission, Options sequence, TCP Timestamp, TCP ISN, which allowed us to estimate and analyze the reaction of different systems on them.

Keywords: TCP/IP stack, active fingerprinting, transport layer, protocol.

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INVESTIGATION OF THE MODEL OF THE VIBRATION MEASURING CHANNEL OF THE COMPLEX MONITORING SYSTEM OF STEEL TANKS (p. 45-52)

Nadiya Bouraou, Sergey Tsybulnik, Dmitry Shevchuk

The presence of defects and damage incurred during the manufacture, installation and operation raises the problem of controlling the technical condition of critical structures of engineering and construction facilities on one of the first places in the diagnosis of objects. In the modern world practice, this problem is solved by using complex intelligent monitoring systems. Due to the wide range of opportunities, these tools for functional diagnostics are widely used in various industries.

The paper considers the problems of improving methodical, software and hardware support of the vibration measuring channel. In the software environment LabVIEW for signal recording, the virtual device with support for up to seven measuring channels (two accelerometers, one inclinometer, and four strain gauges) was developed. In the mathematical package MATLAB, the processing program of diagnostic information was implemented. In the processing program, the possibility of excluding the constant component from the measured signals was added. Assessment of the impact of ADC noise on the useful signal was performed. In the graphic package CATIA, a simplified three-dimensional model of the tank with the volume of 0.04 m³ was developed. Simplification of the model lies in excluding certain structural elements for optimizing the ratio “calculation time/ accuracy of the results” in the simulation.

The vibration signals were produced by impulse excitation of structural oscillations. The length of each signal is 8192 points for optimizing processing algorithms. Using the software package ANSYS, a modal analysis of the structure was carried out. It is shown that the efficiency of the model of the vibration measuring channel is over 90 %.

Keywords: vibration diagnostics, vertical steel tank, LabVIEW, diagnostic system, ANSYS.

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COMPARISON OVERVIEW OF AN ACTIVE FINGERPRINTING APPLICATION OF THE SECOND AND THE THIRD LAYER OF TCP/IP STACK (p. 53-59)

Volodymyr Mosorov, Sebastian Biedron, Taras Panskyi

Nowadays, computer networks have become as popular as telephone networks fifteen years ago and by the year they are playing ever more important functions in human life. Not only they have created huge opportunities in many areas of life, facilitating communications or obtaining information, but also have provided on-line entertainment as well. The invention, originally developed for military purposes in one of the darkest periods of human civilization, has become the greatest discovery of the twentieth century, connecting millions of people around the world into one big community. Whatever the differences in size or devices used, a computer network

can be defined as a combination of terminal devices, transmission medium, intermediate communication devices and network software (network area). Currently, anyone can build their own network or join the largest of them – the Internet – via a local Internet provider. Unfortunately, the Internet is not only a virtually unlimited source of information, entertainment, communication, and work. Alongside its positive aspects and conveniences it poses numerous risks to uninformed users. This publication aims to cast light on the aspects of the method of sampling operating systems security of network computers, i.e. active fingerprinting of the data link layer and Internet TCP/IP stack layer.

Keywords: TCP/IP stack layer, data link layer, active fingerprinting.

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