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Editorial

Green Computing, Monitoring and Assessing of Smart IoT Systems and Components

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THIS editorial paper briefly outlines the Special Issue on GREEN COMPUTING, MONITORING AND ASSESSING OF SMART IOT SYSTEMS AND COMPONENTS at the International Journal of Computing.

Information and communication technologies and IT-based systems are, on the one side, a mean for energy systems and grids monitoring, control and instrumentation, power low management and safety ensuring. On the other side, IT-based systems, networks and infrastructures are weighty consumers of energy and other resources. The most challengeable IT domains, which can be called energy or power consumption critical, are mobile and Internet of Things (IoT) systems, cloud services, sensor networks.

For such systems, time of autonomous operation is extremely important. The same challenge is key for embedded devices and systems for human, transport, space and other industry applications. Development of green software and green computing is a hot trend of IT engineering as a whole. The primary purpose of the special issue is to discuss these problems. Besides, it is very important to discuss methods of testing the IT-systems based on mentioned technologies and its application for monitoring the objects of critical energy infrastructures, ecology monitoring and so on.

This special issue includes selected invited papers presented at the scientific seminar "Critical Computer Technology and Systems" of Computer Systems, Networks and Cybersecurity Department of National Aerospace University KhAI (Ukraine, 2019-2020) and two IEEE Conferences: (i) Intelligent Data Acquisition and Advanced Computing Systems (IDAACS, Metz, France, September 18-21, 2019); (ii) Dependable Systems, Services and Technologies (DESSERT, Leeds, UK, June 3-5, 2019).

The paper [1] is devoted to the research of choice and application of tool for penetration testing of web applications. The difficulty of the choice is caused by a large number of tools with the similar functionality and requirements to them. In this paper, a solution of the problem with making a choice by creating a Web service using a neural network (NN) on the server side is proposed. The NN is trained on data obtained by experts in the field of penetration testing. A trained NN selects tools in accordance with specified requirements.

Examples of the operation and the effect of the number of NN learning epochs are described.

The advantages of the method are the simplicity of implementation (the number of lines of code is used as a metric) and the possibility of using opinions about tools from various experts. The restrictions are a necessity of searching data for training, and the possibility of situations when the NN will not be able to select the tool that meets the specified requirements. The suggested solution can be improved by implementing the dynamically updated web service and considering new metrics of penetration tools.

The paper [2] is devoted to the study of cloud technology application for testing systems and components of critical energy infrastructures (CEI). Cloud technology is applied to ensure the effective functioning of management system for CEI, in particular, improving the informativeness of Supervisory Control and Data Acquisition system by the application of additional Wide-area Measurement and Control Systems (WAMCSs).

Most of processing and transition operations for data

information streams of the WAMCSs can be performed by using clouds. Hence, it is important to get the modeling results considering the wide area range of input data and latency time between CEI and cloud infrastructure components. Simulation models, considering the cost time, are more preferable than mathematical models.

According to the developed conception, authors suggested employing the simulation model based on virtual technology and Matlab Simulink toolkit in order to get modeling results for more important on-line mode of functioning the WAMCSs.

The paper [3] presents the method of developing a monitoring system based on wireless sensor networks (WSN). The purpose of the paper is to implement a system for environmental WSN based monitoring and solve the problem of covering the area. Authors investigated WSNs involved in environmental monitoring and interactions between wireless networks and data communication protocols. During the experimental research authors checked what maximum distance of the temperature parameters can be transmitted. The experiment has conducted with and without interference.

The paper describes the routing algorithms for transmitting the measured parameters (temperature) from sensors to the server. Besides authors developed the terrestrial monitoring system layout for environmental monitoring based on Zigbee WSN technology, which can provide adding (to this network) new units or their replacement.

The Mesh topology is selected and the separate physical devices that are the nodes of this network are identified. Nodes are also designed, using modules from Digi called XBee as a base station for Arduino sensors and as the ZigBee data base. These nodes are investigated for noise immunity and stability using flame, smoke and temperature sensors. The study found that XBee nodes are very unstable working near Wi-Fi routers and interfering in the form of forest. The proposed method for the location of the ground forest fire monitoring system's equipment ensures the full control and the preciseness of flame detection.

The paper [4] is devoted to the improvement of green and performance measures of IoT system using the special methods of data compressing. The IoT is a modern paradigm for creating the system consisting of heterogeneous intercommunicated devices that send and receive messages in various formats through different protocols.

Thanks to the smart things mainstream, it is becoming common to collect the large quantities of data generated by resource-constrained and distributed devices at one or more servers. However, the wireless transmitting of data is very expensive. Therefore, it is needed to compress data on smart devices and IoT communication. Authors introduce the IoT compression method based on the concurrent Cosine and Chebyshev Discrete Transforms.

For performance increasing, the modification of Transforms algorithms is proposed. This method is suitable not only for IoT devices collecting data but also for the big servers and server based systems.

The paper [5] is devoted to developing the concept of software requirements profiling (SWRP) for subsequent quality assessment with the emphasis on a design of the SWRP quality model. The model describes characteristics and attributes of software requirements and their classification features, characteristics and attributes of SWRP and their classification features, semantics and syntax of software requirements.

This paper is based on analysis and using the following standards ISO/IEC 25012:2008, ISO/IEC/IEEE 29148:2018, ISO/IEC/IEEE 29148:2011. Authors discuss examples of SWRP quality model application. The model has been used for an assessment draft of the new standard "Requirements to computer security of NPP Instrumentation and Control Systems (NPP I&C)".

Thus, the collection of papers above presents the hot topics in areas of green computing, smart IoT systems and technologies of their development, testing and monitoring. Editors believe these topics and presented theoretical and practical results will be interesting and useful for researchers and engineers.

The paper [6] is devoted to investigating systems of space monitoring climate measures using the special methods of data processing. Climate models are developed to research the response of the monitoring systems to various forcing as well as for climate predictions. The combined use of the data from remote sensors and weather stations allows taking into account the spatial and temporal components of monitoring. In this paper, the temperature forecasting technique was improved by using the data from thermal imaging satellites and weather stations.

The proposed technique is based on the model of dependence on temperature received from satellite imagery regarding the temperature obtained from meteorological stations. During the investigation of the variables selected from the input data array, authors have shown that satellite imagery data can be used in regional models for temperature prediction.

Besides, temperature traces obtained from satellite imagery and weather stations at similar points show analogous dynamics. Authors confirmed the effectiveness of the group method for data handling using the multi-row algorithm for forecasting temperature for areas with no meteorological stations.

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