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Overview of Progressive Evaluation Methods for Monitoring of Heat Production and Distribution

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Abstract

The contribution describes the specific approach to the monitoring and evaluation of heat production and supply/distribution. The approach is based on application of progressive evaluation methods such as computational intelligence techniques. The proposal consists of data collecting module and monitoring/evaluation module. It is clear that to collect a large amount of data concerning heat production and distribution is a relatively simple task. It depends on selection of parameters, application of sensors and meters. The measured values are read with SCADA-type software. Following step is of a higher complexity: a decision, what to do with the data. The useful data processing is focused on efficiency, predictability, optimization of processes, and possibly on synergistic effects.

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Keywords: Heat production; heat distribution; monitoring; computational intelligence;

1. Introduction

A substantial part of the primary energy resources is consumed in buildings due to the heating/air-conditioning requirements. This consumption results in increased greenhouse gases emissions and negative environmental impact. In the context of sustainable development, the required heat should be produced and distributed with an account to the limited natural resource use and low environmental impact.

Total energy required for the particular energy service is often indicated as primary energy consumption. It includes all energy/fuel inputs, and potential energy losses along the energy distribution net. The primary energy use, e.g. operating buildings, thus depends mostly on energy/heat production and distribution processes. To

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determine the primary energy use, it is necessary to identify the energy efficiencies of the involved processes. However, minimizing the amount of purchased energy does not mean that the natural resources use or the building life cycle emissions are also minimized [1, 2].

Minimizing of primary energy use can be achieved by several ways. Besides a common approach of improving the performance of the buildings (better insulation, progressive HVAC systems) also monitoring, modeling/simulation and prediction of energy systems behavior on various levels are getting more attention. Advanced models can be applied not only for monitoring and data storing but also as state-of-the-art control tools. To achieve this goal, however, the control systems have to be based on verified, reliable models. It is likely that such models are based on the newest top-notch computational methods such as artificial intelligence and computational intelligence. These terms may raise a lot of questions concerning the precise meaning of “intelligence”, nevertheless, it is obvious that these approaches have found their way into numerous human activities that require processing of large amount of data, and decision making based on these data. [1, 3, 4].

2. Data Acquisition for Monitoring of Heat Production and Distribution

The heat monitoring data provide necessary input for the evaluation models. The data sets consist of several parameters measured in particular time intervals. The most typical parameters are: external and internal temperature, heat consumption, gas/electricity consumption, heating medium temperature and flow rate, possibly also wind speed and sun irradiation values if applicable [5, 6].

The monitoring data are usually acquired by SCADA (Supervisory Control and Data Acquisition) system. SCADA system is a type of industrial control system. SCADA is a system for remote monitoring and control, it operates with coded signals over communication channels.

SCADA systems provide data sets of monitored parameters; however, they do not contain higher level evaluation units. Typical data acquisition with SCADA includes meter readings and equipment status reports. Example of SCADA system user interface is shown on Fig. 1.

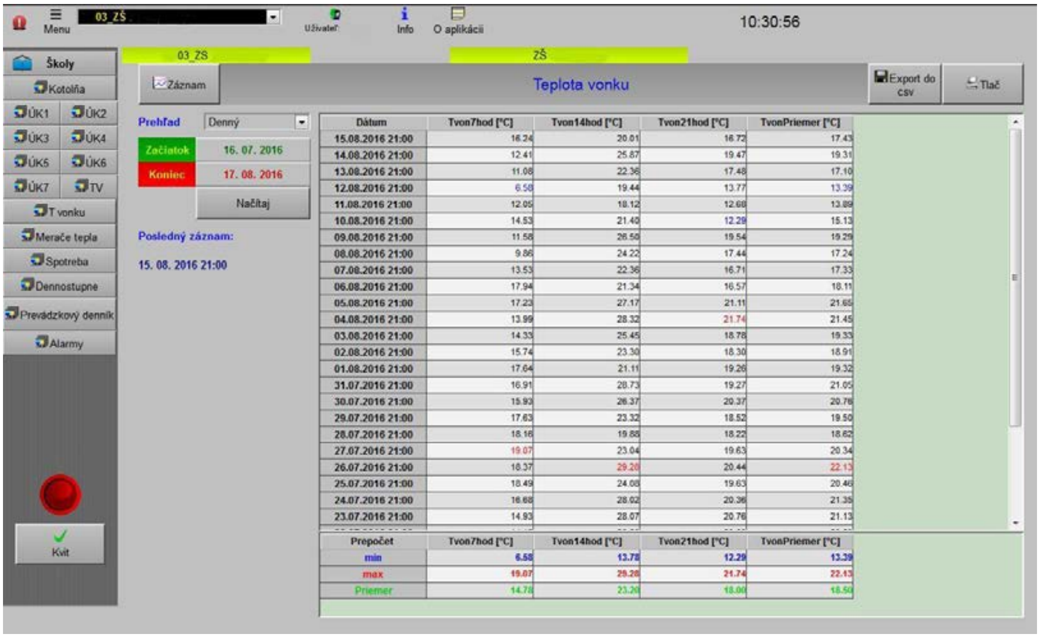

Fig. 1. SCADA system user interface.