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Energy Pulse: Competitive and Accessible Application for Monitoring Electricity Consumption

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Abstract: The present work brings to the reader's attention the benefits and facilities of the Energy Pulse application. The application enwraps a complete solution for real-time monitoring of electrical energy consumption of the Faculty of Electrical Engineering buildings, the Swimming Complex from the Technical University of Cluj-Napoca, the Faculty of Building Services Engineering, and from Marasti Student Campus dormitories.

Keywords: electricity consumption, database, software application.

1. Introduction

Given the importance of efficient use of electricity, this paper aims to present a complete IT solution for home and industrial users in terms of monitoring electricity consumption and reducing the cost of the related monthly invoice, to create habits of efficient electrical energy consumption.

Starting from the decentralized data sets that the BEMS UTCN application generates, in this research, the authors aim to develop an integrated solution for monitoring electricity consumption. Following the analysis of consumer data over several years, and the centralization of consumption data in a database, the authors aim to send personalized notifications to the user according to the consumption habits he has. Subsequently, the user will be able to choose from a series of percentages with which he will be able to reduce the cost of his monthly bill, and the Energy Pulse application will automatically disconnect some non-essential consumers, their number being determined according to a control algorithm.

2. Results and Discussion

In order to obtain the best possible results, the authors of this paper aim to develop a new algorithm for forecasting electricity consumption, starting from the results obtained through the algorithm used in [1]. Using the capabilities of the algorithm mentioned above, the authors will add other relevant parameters for electricity consumption, identified from the experiments, in order to increase the efficiency of the prediction: the evolution of temperature and the type of activity in the analyzed day. In this sense, the temperature data provided by the Copernicus program [2] will be used, along with the definition of four categories of day types. To this end, the authors aim to reduce the training time required for a neural network and to facilitate access to information relevant to the end-user.

Moreover, considering the way of saving data in decentralized CSV files by BEMS UTCN application, in order to reduce the execution time, the authors will develop a database containing the centralization of all consumption data saved by the previously mentioned application.

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Taking into consideration the reading errors that have been identified in the process [3], [4], the future application will use improved methods for detecting outlier data, which following the standard deviation of the data will update the threshold parameter according to the results obtained previously from the experiments.

In order to validate the future results, the authors will compare them with those of the usual forecasting methods for electricity: MARS, SVR, ARIMA [5].

The final results will be presented to the user both in graphic form and in the form of a notification. In graphical form, the current consumption will be compared with the typical one. The text of the personalized notification will contain information regarding the cost of the monthly invoice and the savings that the user will achieve if he continues to develop the same consumption habit. If the user wants to reduce the cost of the monthly bill, to increase his savings, the Energy Pulse application will allow him to choose a certain percentage of cost reduction. Depending on the user's wishes, the application will automatically disconnect non-essential consumers to obtain the percentage imposed by the user. In order to determine the number of non-essential consumers that must be switched off automatically, a control algorithm will be used, determined after comparison with the performance of the fractional control. Fractional control is a generalization of classical PID control, keeping the meaning of each term but offering performances which cannot be achieved with classical control.

In order to fulfil their objectives proposed in this abstract, the authors will use the facilities offered by the MATLAB development environment, together with those of MATLAB App Designer and MATLAB Web App Server.

3. Concluding Remarks

As a result of the above, this paper aims to draw attention to the facilities that the Energy Pulse application will have. Given its competitors, developed by Efergy [6] and Sense [7], the Energy Pulse application will further integrate the notification of the cost of the monthly bill and can be operated by any smart meter owner, without the need for installing additional devices.

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