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MODERN TECHNOLOGIES TO INCREASE ENERGETIC EFFICIENCY IN HOSPITALS

R. SZUHANEK[1] L. FLOROIAN[2]

Abstract: *This work presents an intelligent and integrated management system for the buildings in conditions of heating, ventilation, air conditioning and lighting proposed with aim to significantly reduce the important energy costs, installation and maintenance. Integration represents the central control of electrical users and generators and all the stages of the processes, from programming to operating. Innovating integration platforms are much more than some protocol converting units, they allow the consistent integration of various control systems in a general solution without needing much gateway equipment and many instruments and they are capable to understand many protocols.*

Key words: *integrated management system, reducing the energy costs.*

1. Introduction

In Europe buildings are responsible for 40% of the total amount of energy consuming. Hospitals in particular need a lot of energy because of which they display a huge potential for a reasonable use of energy saving. The main costs linked to energy, setting up and mending can be significantly reduced by using an intelligent and integrated management system for the buildings in conditions of heating, ventilation, air conditioning and lighting.

In hospitals, electric power is generated by using various energy sources (fuel oil, natural gas, coal and regenerating sources) and is it used in different parts of the building as heat (warming and ventilation), cold (air conditioning, refrigerating rooms and surgery units) or power (the functioning of medical and technical systems, building equipment, lighting, lifts). The heating, ventilation and lighting systems [1], [2] are the main energy consumers (Figure 1).

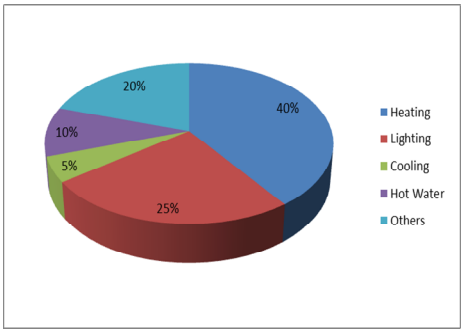

Fig. 1. *Distribution of power consumers in hospitals*

History shows that a more efficient control of these consumers can reduce the total energy use with up to 20% in a typical European hospital [3], [4].

[1] Industrial Engineering Dept., *Politehnica* University of Timişoara.
[2] Automation and Information Technology Dept., *Transilvania* University of Braşov.

The energetic efficiency of the heating and ventilating systems can be improved by various measures. First of all, it should be controlled if the generation and the distribution of heat are efficiently taken care of. The same thing is valid for the appropriate temperature of every room. The improved scheduled programs ensure the correct temperature at the given time and moment. The control function of air quality must be controlled too. The intelligent systems for room filling prevent the heating, cooling or ventilation of unused rooms. The filling state is established with movement sensors in order to make sure the fact that energy is used when only it is really necessary. The automatic lighting systems with movement sensors and a constant control of lighting help to reduce the amount of necessary energy for illumination. All the described measures visibly reduce the necessary power amount.

2. Experimental

The integrated control of the various systems leads to an even more reduced usage. Integration represents the central control of electrical users and generators. A large amount of information must be exchanged between the different providers for this reason. This exchange is made possible by an intelligent integration solution which can be easily applied at low costs and significantly improves the energy efficiency of a hospital. All the stages of the process, from programming to operating, will be put in practice by using a standard software instrument.

The lighting system (DALI), the network controller (BACnet), the individual room controllers and the room control units (LON), the gas/air compressors and the cooling systems (MODbus) will be integrated. All providers will be connected to the central control unit, being used in a central way. The integration lighting system will be specially taken care of in the automatic building system. Some conditions regarding the intersected usage of providers: this operation must be open, flexible, transparent, intelligent and modern. An individual solution must be avoided at all costs in the absence of adjusting the system according to the behavior pattern of the users. It is also very important the levelling of the costs at a position which should not go over those of a "standard solution" and the existence of an obvious advantage regarding its functional nature.

Gateway solutions (Figure 2), over-specialized hardware and software solutions, used to transform protocol A in protocol B, are old-fashioned, even if they are frequently used. They are inefficient and need permanent revision. Moreover, those solutions are difficult to install because different gateways must be used for each protocol.

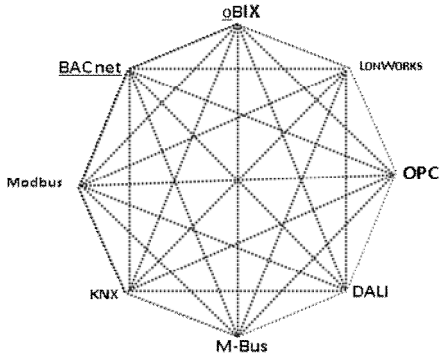

Fig. 2. *Gateway solutions*

Different software packages are necessary in order to establish each solution. Changes and extensions are especially difficult to put in practice since the impact on the whole system, including all the gateways, must be taken into account each time.

Innovating integration platforms are much more than some protocol converting units. They allow the consistent integration

of various control systems in a general solution without needing much gateway equipment and many instruments. A modern integration platform must be capable to understand many protocols.

3. Results and Discussions

The central system and the web multi-linguistic platform ANK constitute an example of a very good solution. ANK functionally allows all important protocols needed to set automatic units in buildings because the protocol drivers for BACnet, LonWorks and Modbus are already included in the standard ANK package. ANK allows an integrated and transparent configuration of all protocol drivers, using only a web browser.

The integration platform represents an intelligent control system having access to all the subsystems in the building. It can perform activities such as: data processing (e.g. programmable logic); data stocking (e.g. recording the past power usage); data visualizing; helping operate the system; allowing distance access in the system.

In this way, new quality and transparency can be obtained by installing integrated systems in order to make automatic units in the hospital. The graphic web ANK interface offers total access to all the functions of the system. The last users can access all the technical systems from the interface with the user. All these aspects are found "under one roof".

Integrated systems are operated through a central unit, having a unitary functioning structure. The usage of coordinated instruments leads to a more efficient installation and operation, as well as to a visible reduction of the costs linked to instruction and to the personnel of the technical team of the hospital. Central functions, such as schedules, have to be adjusted only once by the user, as afterwards they are continuously operating on all technical services. This aspect reduces the critical system errors.

Integrating sub-systems in a hospital can be done by using the integration platform ANK. The ANK systems which are installed in various parts of the hospital connect to a PC server through BACnet where they are monitored and commanded.

The lighting system will be integrated in the automatic network of the building, using the DALI protocol. A special feature of this solution is that the electronic ballasts can be integrated directly in the platform. The DALI network is configured

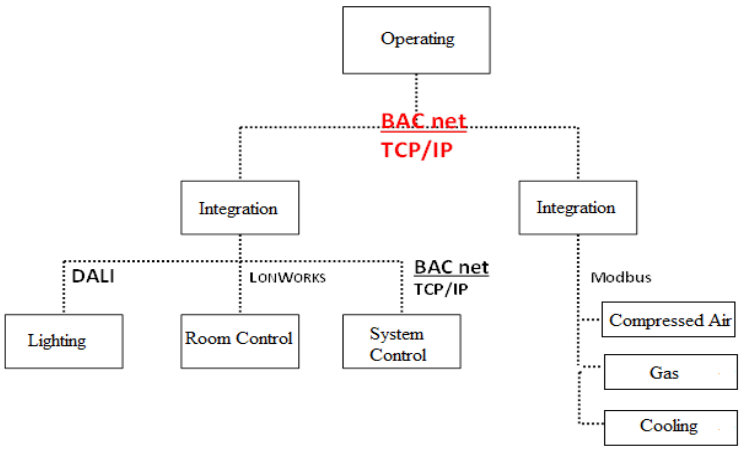

Fig. 3. *The plan of the integrated control system*

through ANK using the best DALI components (Figure 3). The ANK control functions can be directly connected to the DALI components, a fact which allows the programming of any interrelations between individual systems.

In the case of the controlling system, the changing commands from the LonNWork components - e.g. the room control units - will be transmitted to the DALI lighting groups.

In the case of ANK, all the integration logic can be modified online. Thus, the integration logic describes which control unit operates a certain DALI lighting group. It has considerable advantages when renovating or reorganizing the rooms. The gas/air compressors and the cooling instruments can also be integrated in ANK through Modbus.

Being a hospital with large buildings and highly-demanding installations, the access options and distance programming provide many advantages. Since access is completely obtained through a standard web browser, it is not necessary to install or to take care of special programming software.

Thus, ANK can integrate the following functions: DALI - lighting system, BACnet - controller and central control unit, LON - individual room controller and room unit controls, Modbus - gas/air compressors and cooling instruments.

As one can see, even the lighting system is configured due to the integration platform.

The configuration instrument COX is used for this purpose, being especially put to practice for ANK. COX configures the controllers for heating and ventilating appliances, logic and alarm appliance or counting and monitoring appliances too. The instrument is used from the integration stage to the visualizing one.

4. Conclusions

Our proposed system of integrating technical services in a hospital has a lot of advantages. First of all, integration makes sure efficient functioning and allows the careful supervision of usage costs. Putting in practice of an integration platform simplifies the system form a lot. Through ANK, operators have complete control over power consumers and sources. The lighting system is also configured by using the integration platform. No further logic units are needed because there is a direct way from the controller to the electronic ballasts. The lighting system operation is totally done by ANK. This means that the function process changes are easy to put in practice from the web browser. The control functions - such as the constant control of light, the schedules for the lighting system and the plans for emergency lighting - are directly put in practice in the controller and, if necessary, they can be reprogrammed by using a web browser.

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