RESEARCHING AUTOMATION OF LIGHTING SYSTEM OF BUILDINGS

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Annotation. The article aims to extend the life of electrical devices and save electricity by automating the lighting system of educational buildings, organizations, offices, hospitals, hotels, and dormitories. Examples of modern, compact, reliable, efficient devices that meet today's requirements are connection schemes.

Key words: lighting system, motion sensor, light sensor, chain, magnetic cable.

Introduction. Currently, energy-efficient technologies are widely used in various fields. However, despite this, we can see that lighting devices are working in some business organizations even during daylight hours. In order to eliminate these situations, it has recommended switching to fully automatic control of lighting systems. For this, it is appropriate to use light and motion sensors in the control chain of the lighting system. As a result, it is possible to extend the life of lighting lamps and save electricity consumed in the lighting system of the enterprise. In the presidential decrees aimed at updating these areas, great importance had attached to the development of this direction [1]. Therefore, based on this, we will analyze this issue in a simple example. The educational building consists of four floors, except for the classrooms on each floor, there are stairs and corridors on each floor, the number of lighting lamps installed in them is on average fifty, based on this, the total number of lamps on the floors is two hundred.

Materials and methods. The energy consumption of each lamp is forty watts, so multiplying this by the number of two hundred lamps will result in their total energy consumption. This is only for one day, but how much electricity it consumes in a month or a year can be found through simple mathematical calculations. It is possible. So, it can be seen from the above that even if turning on and off the lamps is entrusted to a responsible employee of the enterprise, in some cases it will cause damage to the organization due to forgetfulness or carelessness. For this reason, it is not difficult to understand to what extent the use of light and motion sensors is a suitable solution for lighting systems. Below is the connection diagram of light and motion sensors.

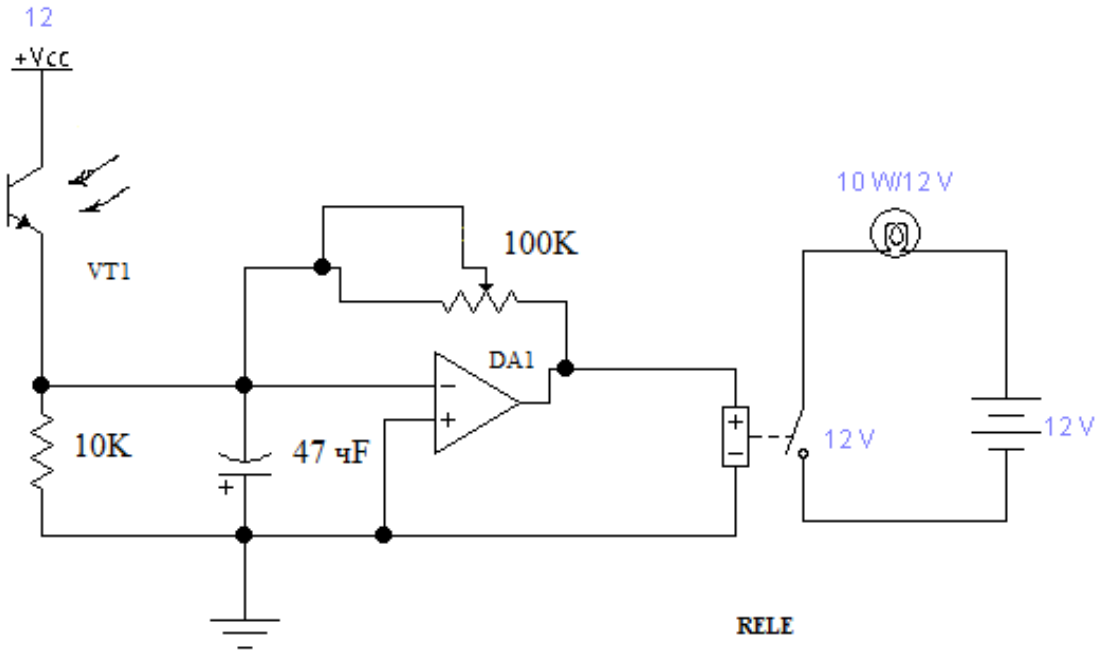

Figure 1. The light and movement sensor connection diagram is presented.

Building Automation Systems (BAS) provide automatic control of the conditions of indoor environments. It is a network of integrated components that manage a number of sensors and actuators within the building. The systems typically control HVAC, security/access control, lighting, energy management, maintenance management and fire safety. A Human-Machine Interface (HMI) is provided to give maintenance personnel a single view and control access to all technical facilities and tools to monitor energy consumption [2]. All three functions can be identified on a typical building automation system. The topmost HMI –layer can be a stand-alone or client-server system built on top of some graphical user interface development. There can be several different HMI's in the same building. There can be wall-mounted touchscreens for local room control, a user interface for specific controls installed on smartphones and then a control room that provides a view and access to all HVAC and electrical systems in the building. Figure 2 illustrates the main parts of the building automation system with generic terms used in industrial automation.

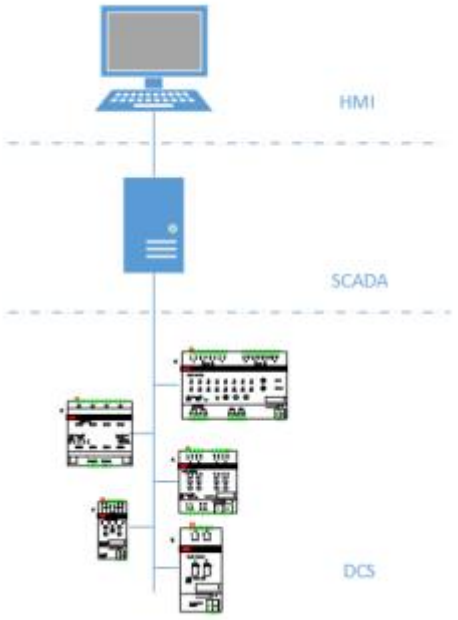

Figure 2. Building automation system with generic terms

In practice, this means that in order to meet the planned luminance levels, there should be an option to manually adjust the pre-sets according to the actual, measured light output. This is mandatory especially when the luminance contrast is an essential element of the lighting design. Naturally, this adjustment is part of the maintenance routines, since the lamps and ballasts may would be replaced with another types and their light output and dimming characteristics will be different. The light output of lamp will also decrease over the time due to its ageing and a calibration of the programmed scenes might be required [3]. The building automation system is typically a combination of several subsystems that are based on different technologies. Because of this, various interfaces are required in interchange information between the subsystems. This also brings the elements of IT network topology design into projects, since the designer have to carefully design the system architecture to balance traffic on all the branches to avoid bottlenecks and to maintain acceptable security. Figure 3 provides an example of a building automation system that covers the control of HVAC, lighting and access control. Ideally, the lighting system objects are the easiest to locate when displayed over a floor plan. In a large building, the floor plan view should also be scalable and able to display only part of the building. Different colors in the display make it easy to define control areas and to identify point requiring immediate attention [6]. The icons of controllable objects should be carefully considered in order to provide a quick view on the status on larger area. As an example, the operator would need to know whether the lights on certain space currently controlled manually, by timer or by presence indicator, since the operating mode may change during the day.

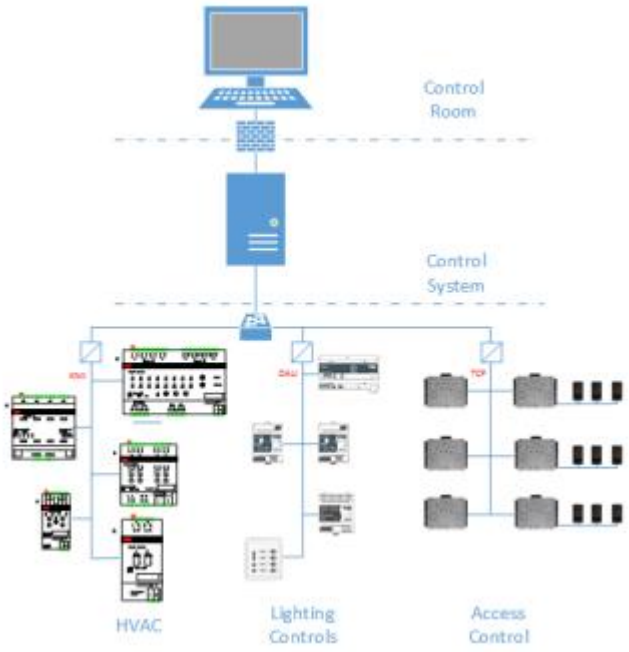

Figure 3. Building Automation System

Some HMI –systems provide an option to illustrate the system also in a form of standard single-line diagram. When choosing the system attention should be paid on whether the additional viewer modules provide the same control functions: they might be only viewers and not provide any actual control options for the objects displayed in the screen. A user familiar with other Windows software applications have expectations on when seeing an object on a Window, clicking or right clicking it would provide some functions [7]. In addition, the user would expect that when an object has the color of red, it provides a warning and when it is green, it functions correctly. In some designs, the lighting design concept also includes control of motion. As an example, the position of a lamp may be automatically adjusted according to a plan. It is also important to calibrate the presets so that each lamp provide the same color temperature since variance looks unprofessional especially on long light strip type of fixtures. This calibration process might require a repairing after a couple of years of use.

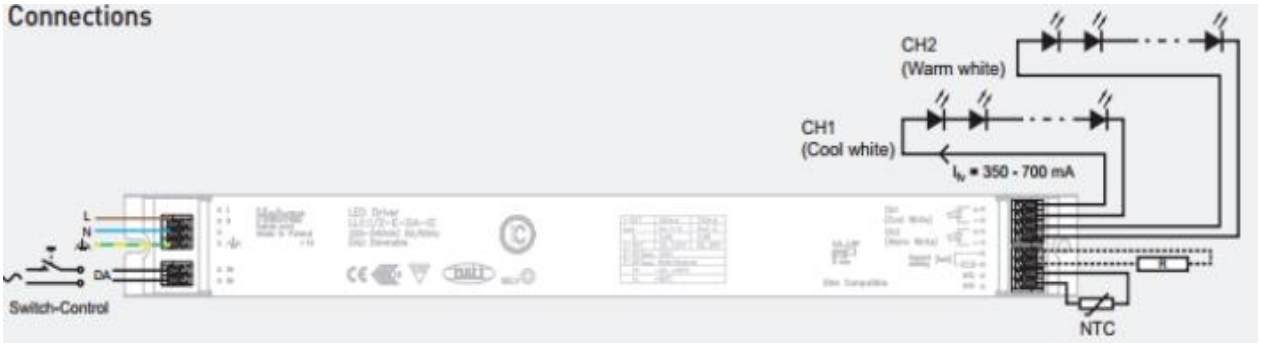

Figure 4. Helvar Tunable White LED Driver

Dynamic lighting has typically based on technology where LED lights of different color temperature are mixed and the ratio on which each type is driven defines what the color temperature of total light output is. Helvar provides a specific 'Tunable White' two-channel LED driver product for such cases [5]. The dynamic lighting concept has based on lighting scenes that combine the control of both light intensity and color temperature. The recent research indicates that the light qualities of illumination and color temperature might influence student gains in reading. When drivers like these are used, the lighting control system must know how to manage the mixture of these two channels to provide desired output. A recent research has added one interesting function to the list: dynamic lighting [4]. The goal is to mimic the natural rhythm of night and day that our bodies respond. By positively affecting the human biological clock, wellbeing has stimulated and the person kept alert and refreshed.

Conclusion. In short, the effect of using light and motion sensors for one enterprise means that it is possible to leave our energy resources to future generations.

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