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POSSIBILITIES FOR REMOTE CONTROL OF HOUSEHOLD LIGHTING INSTALLATIONS

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Abstract: *The report presents opportunities for remote control of residential power customers. Some options for managing on lighting systems are described. For all the solutions described, their advantages and disadvantages were analyzed. The optimal solution for remote lighting control using the existing WiFi network and the capabilities of mobile devices to provide a convenient control is selected. On the basis of the chosen decision a demonstration stand was made. A standard module for wireless control via WiFi is used. The advantages and disadvantages of the described solution are considered, as well as the possibility of integrating it into a common BMS system for complete building management. The relevant conclusions are made.*

Keywords: *Remote control, Lighting installations, BMS*

INTRODUCTION

With the development of technology, so is the desire of man to use this to facilitate his daily activities. The use of remote control for different processes is now also possible in lighting control. There are currently multiple devices available on the market, in different price ranges and with many different features. Solutions can be chosen from the "simple" switching on and off of a single lamp with remote control to complex solutions that allow complex control of entire lighting systems by a mobile device at a remote distance from the site.

The purpose of this article is to review the various technical solutions available on the market and to select a mid-range device that allows flexible lighting management. On the basis of the chosen decision, a demonstration stand for remote control of lighting systems was made.

EXPOSITION

Historical development of remote control capabilities

The first remote control was created by Eugene McDonald, founder of Zenith TV Corporation. He hated TV commercials. MacDonald decided to sabotage the ads on television. He tasked his engineers with the task of creating a device to switch channels and stop the sound from a distance (Fig. 1), which would allow viewers to skip the commercials. In 1950, Zenith launched the world's first TV remote control.

It was called "Lazy Bones," making it clear to everyone that the lucky owner of such a device does not need to get off the couch while watching TV. The console was connected to the TV with a wire, rotating the mechanical switch of the TV channels when pressing an electric motor knob.

In 1955, the first wireless remote control for the Flash-Matic TV appeared (Fig. 2). It was a flashlight that illuminated one of the four photocells in the corners of the TV screen. This switches channels, adjusts the volume and switches the receiver on or off. But this console did not become very popular either because lamps or sunlight influenced it.

Fig. 1. The first "Lazy Bones" remote control to be launched

Fig. 2. "Flash-Matic" - the first light wireless remote control for TV

In 1956, the Space Command console (Fig. 3) came to the market with great success, and in 1959 virtually all TV manufacturers equipped their expensive models with similar consoles. Zenith's marketing experts have conditioned the device to have no batteries and engineers have come up with a brilliant solution - a mechanical ultrasonic transmitter. When a button was pressed, a hammer struck a hammer on one of four tuning forks, and the TV, equipped with a microphone receiver, commanded.

In the 1980s, with the advent of infrared LEDs, the familiar remote controls used until now appeared. The first commercial infrared remote control television came on the market in 1972 (Fig. 4).

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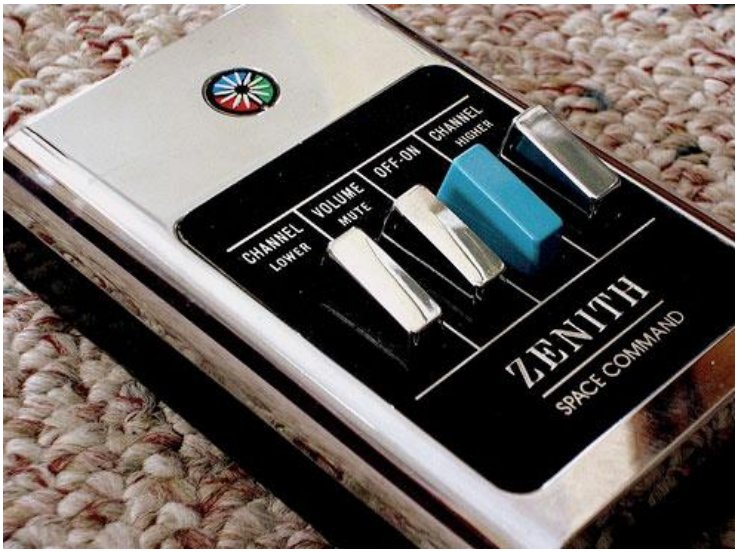

Fig. 3. Ultrasonic Space Command Control Panel (without batteries)

Fig. 4. Matsushita's first Colour Television with Infrared remote control National TH-6600FR

Modern solutions for remote control of lighting systems

Currently, extremely diverse lighting control devices are available on the market. In addition to the features of the devices, there is a lot of variation in their price. Examples of such devices are shown in Fig. 5…8.

In Fig. 5 shows an interesting control solution that does not require modification of the existing lighting installation. The price of the device is acceptable. There are several disadvantages: managing a limited number of luminaires; indoor-only management; ON / OFF function only, etc.

In Fig. 6 presents a similar solution, but the difference is that the control is carried out by separate modules. These devices require a change in lighting to enable the actuators to be connected.

Fig. 5. Remote control of separate light sources

Fig. 6. Remote control of separate light sources, with separate actuators

In Fig. 7 shows a more flexible lighting management solution. The device is a module controlled via a WiFi network. In addition to the on and off functions, smooth control of the luminous flux as well as remote control outside the premises can be implemented. The limitation here is that the control is only done by a single luminaire.

In Fig. 8 is shown to be one of the best complete lighting management solutions. It is controlled by a controller that can be controlled locally by the keys on the premises, remotely via a smartphone or a computer. It is possible to program a complete lighting management program. The system has great flexibility and ability to integrate into a single BMS system. The main disadvantage here is that if this system is not foreseen at the stage of realization of the lighting system, then the integration is a serious engineering challenge.

There are many other technical solutions for lighting management, but given the volume of the publication, not all of them will be considered.

Fig. 7. Remote control of a separate light source using WiFi network

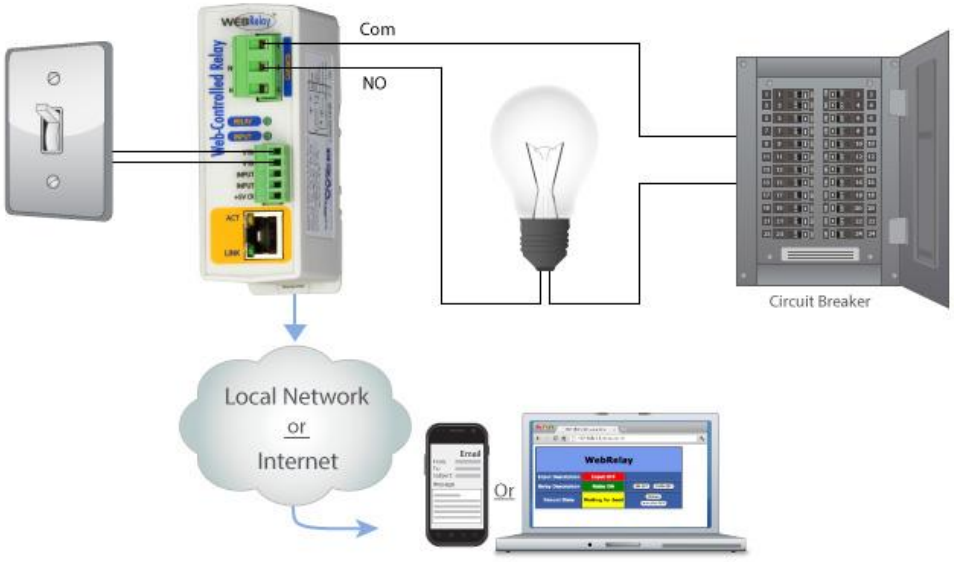

Fig. 8. Remote control of the entire lighting system, using a controller

Implementation of a demonstration stand for the study of modern solutions for remote control of lighting systems

For the realization of a real demonstration stand, a technical solution was chosen, which is of the middle price class. The “Sonoff 4Ch Pro” controller shown in Fig. 9. In Fig. 10 shows the main board of the selected controller.

Fig. 9. Sonoff 4Ch Pro Remote Controller

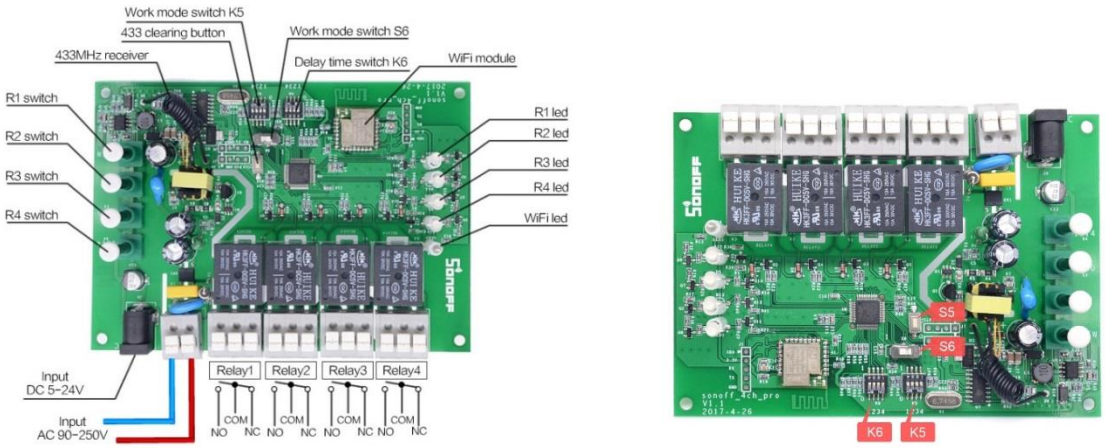

Fig. 10. Main Board on Sonoff 4Ch Pro Remote Controller

In Fig. 11 shows the developed demonstration stand with the application of the selected controller "Sonoff 4Ch Pro". Only 3 of the control channels are used.

The selected controller has the following functionalities:

- Relatively low price;
- Easy control over three channels (local, remote controller and smartphone);
- Ability to manage a group of light sources;
- Possibility to integrate into one common BMS system.

The controller is 4-channel, but allows the connection of an unlimited number of controllers to extend the functionality of the system.

Management can be done remotely from anywhere in the world through Internet connectivity via a local WiFi router or access point.

The main disadvantage of this solution, as well as of most commercially available ones, is the need to change the power supply of the lighting system. The controller allows its mounting to take place directly in the power panel and to control it directly on the created lighting circuits.

Fig. 11. Stand for remote control of lighting systems, with the use of controller "Sonoff 4Ch Pro"

CONCLUSION

The following conclusions can be drawn from the studies and the analysis of the possibilities for remote control of household lighting:

1. Existing solutions on the market offer mainly single-light source control. Light source control units are usually complex and expensive.
2. There are technical solutions for remote control of lighting systems through direct switching or dimming. The latter are complex to implement and show some good reliability of the devices used.
3. As a technical solution, a controller for remote lighting control was selected, using three control channels - directly, via radio frequency and via an existing wireless computer network.
4. The main advantages of the chosen solution are: low cost; easy operation; ability to manage a group of light sources; ability to integrate into a common BMS system and more.
5. The main disadvantages of the chosen solution are: the need to change the power supply of the lighting system; difficult setup of internet connectivity; limited number of management channels and more.

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