

The Modernization Opportunities of the Floodlight System of Prohászka Ottokár Memorial Church using Modern Technologies

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Abstract- The Prohászka Ottokár memorial church has a 52-meter-high dome. When the church was consecrated in 1933, the dome was lit as so in 1938 in the year of jubilee. In the 1990's for several years the cross was lit on Sundays and holidays. However, nowadays the floodlight does not work in the church. The purpose of our research was to investigate the old floodlight systems. Our goal is to examine the possibilities of redesigning the old floodlight system using an environmental-friendly and cost-efficient LED technology. An advantage of the technology is that the system can provide a combination of colours during holidays.

Keywords: LED technology, Floodlight System

I. THE OLD LIGHTING METHODS

The Prohászka Ottokár memorial church was consecrated on 5th November 1933. During the ceremony the big and the small dome were equipped with floodlight as well as the gilded iron cross on the top of the small dome.

The church is located in the neighbourhood of the central railway station in Székesfehérvár. The church was lit for the first time in the night before the consecration ceremony because on 4th November 1933 on the occasion that the archbishop Jusztinián Serédi travelled through Székesfehérvár on the Roman pilgrimage train. The Fehérvár local newspaper reported on the ceremony on 4th November 1933. According to the newspaper article the floodlight was invented by the mayor of Székesfehérvár. He intended to illuminate the church and some other attractions such as statues, monuments and beautiful buildings in Székesfehérvár every Saturday and Sunday.

In 1938 the residents of the city celebrated the jubilee year of King St. Stephen. The church played a key role in the celebration because on 1st June 1938 the ashes of bishop Prohászka were transferred from the Long Cemetery to the Prohászka Ottokár memory church, which was built in memorial of bishop Prohászka. At the time the church was re-installed with floodlight. The dome was equipped with electric garlands in three wreaths.

A newspaper dated back to 19th May 1938 corresponds about the floodlight. According to the newspaper the residents of the city were so impressed that they wanted to

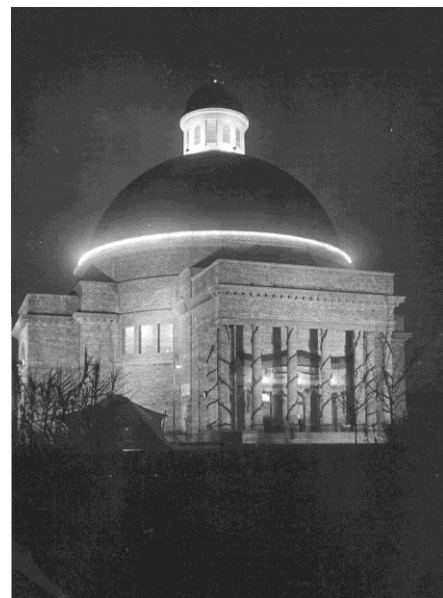


Figure 1. Prohászka Ottokár memorial church in 1938

see the floodlight every Saturday and Sunday thereafter. Therefore it is assumed the vision in 1933's cannot be realized.

Another news item we found about the floodlight references to 2nd April 1939 when the anniversary of bishop Prohászka's death was celebrated.

The last sentence of the article mentions lights and the hundreds of light bulbs.

Five years later, on 3rd April 1944 when the city celebrated another anniversary of bishop Prohászka's death, the local newspaper mentioned that the church could not be lit up due to the fact that the country was under war.

On 19th September 1944 the army sieged the city of Székesfehérvár and the church was hit by several bombs. The copper cladding and the wooden dome structure were badly damaged. The dome caught fire and blazed for 24 hours and wood parts were burnt. In 1945 the church was hit by about 40 grenades. The dome damaged heavily. The renovation began only in 1946 with restoring the big dome in 1948. However, the overall renovation of the dome was

completed in the summer of 1961. From this period we could not find any written notes about the floodlight system.

We revealed that in the 1980's the parish attempted to



Figure 2. The dome burned for 24 hours

partially install a floodlight system. Nevertheless, only the cross was lit by two spotlights on the top of the church.

In this period the parish priest called Joseph Garda issued a regulation. According to this regulation the floodlight was supposed to be operated every Saturday, Sunday and during religious holidays.

The floodlight can be switched on and off manually inside the church.

The church was under reconstruction in 2002. In this time the electrical system was completely renovated. The church was equipped with new electric wires and luminaries. The cross on the top of the big dome was equipped with two spotlights. From this time on only the cross has been possible to be illuminated.

Other designing and modernization efforts aiming the external floodlight were cancelled and the lighting in the cross continues to be operated only manually.

Over the years the spotlights went wrong, so the church has not been floodlighted outside for more than ten years. [1-6]

II. PLANS FOR A NEW ILLUMINATION SYSTEM

We did research with the aim of finding old documents and photos in the church and by means of this information we decided to reconstruct the old floodlight system. Our goal is to equip the big dome's bottom, the small dome's bottom, and, of course, the cross with lighting. A long time ago the people used simple electric garlands, hundreds of bulbs and a manual on off switching system for the implementation.

In our opinion it is necessary to automatize the floodlight system in an energy saving and environmental friendly way. We recommend using the LED lighting systems because they are energy saving, environmental friendly solutions and more resistant than traditional light bulbs.

In the events of religious and state holidays we intend to change the colours of lights in line with the nature of the holidays.

III. ADVANTAGES AND DISADVANTAGES OF LED LIGHTING

The LED lighting has a number of advantages.

The biggest advantage of LED lighting is the energy-saving operation, which is especially important in our case, because we want to shed light on a large surface area applying a cost-effective operation.

A. Advantages of led lighting:

- Light output: In case of traditional light bulbs efficiency is very low, because much of the energy is converted to heat, approximately 8-14lm / W, while the efficiency of LED lighting is very good about 50-80lm / W.
- Endurance: The lifetime of conventional bulbs is around 1000 hours, whereas the LED bulb's life is approximately between 80 and 100 thousand hours of operation.
- Low maintenance costs: The long lifetime of LED lighting systems requires a one-time investment, so the realization of the floodlight system in the memorial church is beneficial, because the system will be installed hard to reach places on the façade and at the bottom of the dome.
- A further advantage is that the system can be operated in small places, the light of Led does not vibrate and it is not bad for the eyes.
- Light controllability: Led lights up where needed and will not cause light pollution.
- If it is necessary the brightness and colours of Led can be controlled.
- Switchable without delay: It is not necessary to wait for warm-up; Led can be lit immediately with appropriate light intensity.
- On / Off - switches: The high number of switches does not shorten the life span.
- Low Voltage operation: The operating voltage of LED strip lighting system is approximately 12-24V; therefore this system offers a high-level safety operation.
- Light spectrum of the LED: The led's light spectrum is narrow, therefore, led does not contain UV or infrared ranges, as a consequence, the light of led cannot damage the material and colours of objects.

B. Disadvantages of led lighting:

- High cost of installation, although it pays off in the long term considering the maintenance and the energy costs.

At the end of our research, we wanted to test our concept regarding the facade of the church in an area where we could place a 5-m long LED strip.

We wanted to operate the partial floodlighting for a couple of nights and get feedback from the parish and the residents in the neighbourhood, thus promoting further implementation of the system, possibly supported by EU funds as well.

Although we could not get all the permits that we needed for the test before the article submission deadline, the realization of our vision is in progress. In terms of

testing, we have created a simple microcontroller-operated circuit. With this circuit we can switch the red and white led strips on and off in twilight automatically.

IV. THE LED STRIP'S PROPERTIES THAT WE USED IN OUR PROJECT

The used LED strips are as follows: - 5050 LED strip of 30 LEDs / m = 420 lumens light output, 7.2 Watt performance. The high-performance LED strips are produced from 5050 mm SMD LED. The name comes from the size, which is 5.0X5.0 mm.

Comparing the 5050 led to the other led strips a larger physical size; larger performance, larger consumption and larger heat emission can be seen. This is due to the fact that inside the 5050 mm 3 pieces SMD LED light emitting chip is located. Theoretically the brightness and the consumption are three times bigger than in case of 3528 led strips.

The led strips that we planned for the church floodlight have IP68 level of protection. These led strips are equipped with a two-layer protective coating.

The first layer of the resin casing is IP65, and the second layer is 1 mm square tubes, which are closed airtight and watertight.

The double insulation provides protection even if the outer casing is damaged. These LEDs do not include adhesive tape layers, thus fixing the fastening of the clips is to be solved.

In case of the church floodlight system it is especially important, since the installation of led strips has to be solved properly because the installation procedure to the high dome is very expensive



Figure 3. LED strip with mounting clip

In the third figure you can see the LED strip along the retaining clip.

V. THE CIRCUITS FOR TESTING

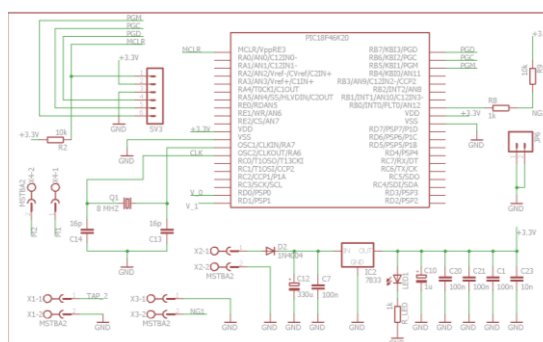


Figure 4. The implementation of testing circuit- microcontroller

In the fourth picture the implementation of testing circuit's microcontroller parts can be seen.

The function of a part of the circuit is the following. By pushing a button we can choose the red or the white led strips to be switched on. The V_0 sign permits the red and the V_1 sign permits the white led strips operation.

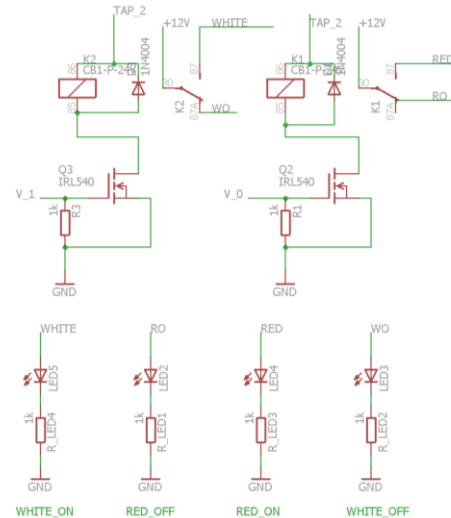


Figure 5. The enable signal help to drive a relay

The fifth picture you can see the enable signal is drive to a relay. The circuit has been placed with 4 LED indicator where you can check which colour mode is selected.

After the relay we separately built two dark detector circuits to the led strips. With the help of this circuit we can set up the level of light where white led strips and red led strips must be activated. The solution can be seen in the picture 6.

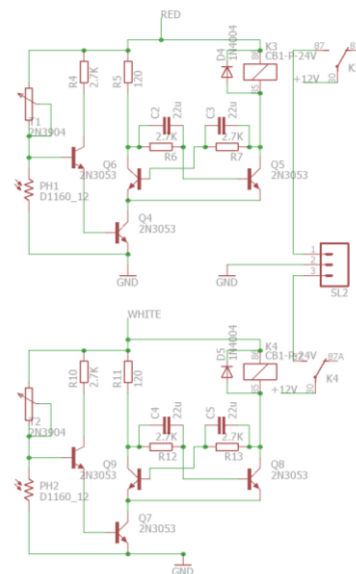


Figure 6. Dusk sensing circuit

VI. SUMMARY

In summary, we believe that our topic is verified by the fact that the residents who have been living in the neighbourhood of the old church for many years would like to see the illuminated domes and the cross on the top of the building.

Our aim was to design an innovative way to effectuate the floodlight system that has long-life and low-maintenance costs, which might be a suitable alternative for the implementation and can be tested involving the environment to correct this.

We hope that within a few years the parish can find adequate resources to install the led strips floodlight system in the church and our idea will be realized. [7-11]

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