

## A case study of modern urban night-lighting

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## 현대 도시의 야간 라이트 사례 연구

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**Abstract** In this paper, the writer studies the lighting technology and types used in urban night lighting performance.

With the continuous change and innovation of life style in today's society, the multiple functions of the city continue to develop. At present, urban night lighting is not limited to lighting the landscape in the daytime by lighting tools. It uses new digital lighting technology to deduce innovative and constantly changes digital nightscape.

In this way, through the integration of urban nighttime lighting and modern digital art, the city's brand image can be improved and its economic development will also be affected. In this way, through the integration of urban nighttime lighting and modern digital art, the city's brand image can be improved and its economic development will also be affected. With the development of innovative lighting technology, urban night scene will provide more rich experience in media design.

**Key Words** : Urban lighting, Urban night landscape, LED, Projection mapping, Digital technology

요 약 본 논문은 도시의 야간 조명연출에 사용되고 있는 조명 기술 및 유형에 대해 연구하였다. 현 사회의 생활방식과 생활양식이 지속적으로 변화하고 혁신되어지면서 도시의 다양한 기능은 끊임없이 발전하고 있다. 현재 도시의 야간 조명은 낮 시간대의 경관을 조명기구를 통해 밤에 밝히는 것에 머물지 않고, 새로운 디지털 조명 기술을 활용하여 독창적이고 지속적인 변화가 가능한 혁신적인 디지털 야경을 연출하고 있다. 이러한 도시의 야간 조명연출은 현대적인 디지털 아트와 융합하면서 도시의 브랜드 이미지를 높이고, 경제적 발전에도 영향력을 미친다. 그러므로 새로운 도시의 건설에서 야간 경관을 결정하는 디지털 조명연출은 중요한 연구가치를 가지게 되었으며, 혁신적인 조명연출 기술의 발달로 앞으로도 도시의 야경은 더욱 다양한 영상디자인적 경험을 제공할 것으로 사료된다.

주제어 : 도시 조명, 도시 야간 경관, LED, 프로젝션 맵핑, 디지털 기술

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## 1. Introduction

### 1.1 Research purposes and methods

The continuous gathering of population and economic life promote the formation of cities.[1] City, can be said to be a symbol of the continuous maturity of human beings and civilization. Modern urban landscape can show the overall urban cultural image. The urban landscape is composed of buildings, roads, landscaping and other elements. As the famous international designer Saarinen said: 'let me see the street, and I can tell what the residents of this city are pursuing culturally.'[2] As one of the indispensable components of modern urban landscape – urban night landscape construction. The construction of urban nightscape can not only improve the image of the city, enrich the functions of the city, but also beautify the urban environment.[3] With the continuous improvement of people's life quality and requirements, more and more cities begin to devote themselves to the construction of urban nightscape. The application of new media technology in various fields makes the construction of urban night scene more possible.

In this paper, The author takes the urban nightscape project as the research object. And the author studied related reports and theoretical papers and tried to analysis of the current situation of urban night scene construction. As well as the development prospect of the urban night view project in the future.

## 2. Theoretical research background

Nowadays, the night scene of modern city is not only the reappearance of night landscape of day city. Urban night view project has become an art work in urban construction.[4] Urban night landscape is the digital shaping of urban material

culture, including buildings, bridges, roads, signs and other urban elements, to show the urban culture.

At present, in the process of shaping the night scene of modern city, the external wall of building has become the main carrier of new media technology. The external wall area of the building is large, and the lighting of the building itself can better combine the lighting landscape of the follow-up construction. At the same time, the external structure of the building such as wall, column, eaves, window, corner and other external structures, combined with architectural lighting and exterior lighting,[5] enhances the artistic expression of the building. The volume of buildings are larger, and the lighting effect is more perfect.

### 2.1 Theoretical research on urban night scene





At present, projection mapping technology and LED lighting technology are mainly used in new media technology.

#### 2.1.1 Projection mapping technology

Projection mapping a kind of digital technology that uses high power projector to project media image on building exterior wall. It uses projector inside and combines with projection technology and digital media technology, to create a spectacular visual effect. Projection mapping technology is always used in various commercial activities, city celebrations.[6, 7] When we mentioned projection mapping in the early stage, we thought more about building projection mapping. With the development of projection equipment and production platform, projection mapping is applied to more types of media surface. Projection mapping technology breaks the physical space well known by the public, transforms any object surface into animation, realizes the fusion of object and animation. It is

according to different projective objects, the following Table 1 lists 7 creative projection mapping methods of projection mapping technology.

Table 1. Creative projection mapping methods[8]

Ground projection mapping
It is mainly used for stage interactive projection performance and interactive exhibition.

Water curtain projection mapping
It is mainly projected videos on water screens.

Heteromorphic projection mapping
It is usually used to project videos on the surface of unusual shapes to show features.

Human projection mapping
It is taking the human body as the projection object, with the help of real-time tracking technology, the display effect is more interesting

Landscape projection mapping
It is projecting videos on the natural landscape to realize the combination of digital art and natural landscape.



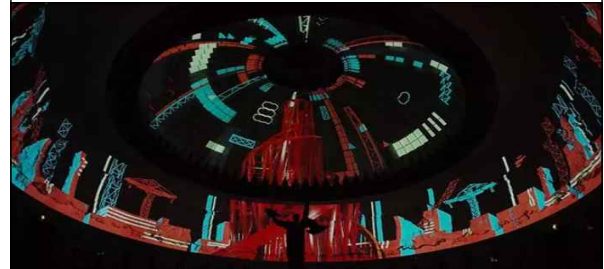
Graffiti projection mapping

Graffiti artists sketch three-dimensional graphics on the wall, and the projection team then projects special effects videos on it



Dome projection mapping





At present, it is mainly used in the dome shaped roof with upward bulge to create 360 degree visual surround effect.



### 2.1.2 LED lighting technology

In the 1960s and 1970s, the first LED appeared. Up to now, LED lighting has the characteristics of small source volume, rich color, good monochromatic property of outgoing light, long life, and can switch on and off repeatedly, realize rapid and diverse changes of light color, and can construct various patterns and etc.[6] It has become the most popular energy-saving lighting source for urban landscape and commercial advertising lighting.[9] The following Table 2 lists ten common LED lighting modes in cities.

Table 2. Urban lighting methods at night [10]

1. Structural space modeling lighting

<p>It is a way to use light source or lamp to connect the structural parts of the building (walls, columns, eaves, windows, corners, etc.) as a whole</p>
2. Flood lighting

<p>A lighting mode in which a projection lamp or floodlight is used to irradiate a scene or target, and its illumination is significantly higher than the surrounding illumination.</p>
Contour lighting

<p>It draws the outline of a building or structure directly by light</p>
Lighting form interior lights
<p>The transmission of light through the interior of the scene.</p>

Multiple space modeling lighting
<p>In scenic spots or scenery environment, a variety of lighting methods are comprehensively used to give the best lighting direction to the scenic spots and scenery. Appropriate light and shade, clear outline and shadow. It fully shows its three-dimensional characteristics and cultural and artistic connotation of lighting</p>



Silhouetic lighting

Also known as background lighting. It uses the light to separate the object to be illuminated from its background to keep the scene dark and form a clear outline image on the background.



Layering lighting

It uses a number of lights to illuminate only the most exciting and interesting parts and deliberately keep the rest dark.



Special lighting

It uses optical fiber, light guide tube, sulfur lamp, laser, LED and other special lighting equipment and technology to create a night scene lighting method.



Lighting used functional light

It uses indoor and outdoor functional lighting (including indoor lighting, advertising signs, street lights of motorway, and etc.) to decorate the outdoor night scene lighting.



At present, with the development of intelligent system, urban night lighting has been incorporated into the centralized management system, which can master the operation status of lighting in real time. Based on the Internet of things technology, through the control center and terminal controller, combined with communication equipment and communication network, more effective management of living lighting and landscape lighting has been implemented.[11] The Fig. 1 shows the operation of the current intelligent city lighting system.

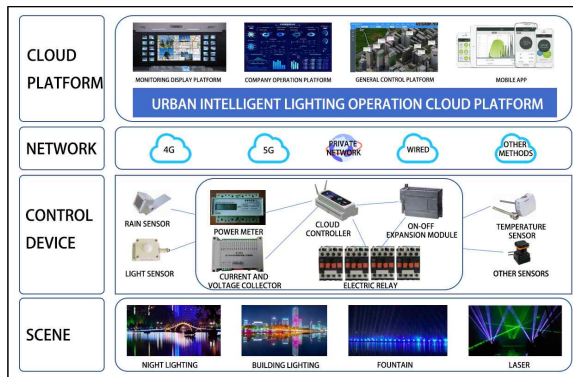


Fig. 1. Operation mode of intelligent city lighting system[12]

### 3. Case study

#### 3.1 Dongdamen cultural and Historical Park 「Souel Light」 lighting show

From December 20, 2019 to January 3, 2020, In Seoul Dongdamen historical and cultural park, a projection mapping show named 「Souel light」 was held. Dongdamen historical and cultural park is a complex cultural space which perfectly combines traditional buildings, relics and modern facilities. It is one of the representative landmark buildings in Seoul. Its main building east gate design square (DDP) is a non-standard three-dimensional building. The design concept of the building is to combine with the surrounding terrain. And the whole building is a

water line without joints. There are no columns inside. It looks like a huge alien spaceship.[13–15] The Fig. 2 shows Dongdamen cultural and Historical Park 「Souel Light」 lighting show.



Fig. 2. Dongdamen cultural and Historical Park 「Souel Light」 lighting show

The architecture of DDP itself is huge, and the architectural shape is very characteristic. 「Sound light」 uses the external wall of DDP building as the media facade to project digital video. The projected video show the past, present and future of Seoul and DDP in three chapters. There are 28 high-end projectors and 62 loudspeakers, which are combined with AI technology to create the whole performance. The large silver metal exterior wall, combined with gorgeous lights, videos and music. It combines modern technology with historical memory to create a wonderful experience of shuttling time and space. During the video projection, the surrounding buildings should also reduce the outdoor lighting as much as possible to ensure the visual effect of projection mapping.

#### 3.2 China city lighting show

It takes the urban buildings as the media facade, and uses LED lights and laser lights to illuminate many buildings and creates the night scene of urban buildings. In 2013, the lighting exhibition of urban building group was built for the first time in Nanchang City, Jiangxi Province. By 2015, with the theme of "one river and two

sides" and the stage of both sides of the Ganjiang River, 293 buildings on both sides of the river will be used as building media to create a light music show.



Fig. 3. Guang Zhou city lighting show

The light show also incorporates micro film. Tourists can board the cruise to watch the show. City Lighting show successfully attracted a large number of tourists, not only improving the local tourism revenue, but also enhancing the value of the city. After that, lighting shows with city as background were launched in more cities in China. By 2020, urban lighting shows will be built in China, Guangzhou. The Fig.3 shows the city lighting shows across China.

#### 4. Conclusion

As a part of urban intelligent lighting, the lighting project of urban night scene represents the development of modern city and the improvement of people's living standard. The technology and digitization of urban night scene will transform the familiar urban landscape into fresh and visual impact. Urban night lighting is not only a lighting tool, but also a continuous stream of economic development and social benefits. With the continuous innovation and change of people's life style and life concept, the role and status of urban nightscape in urban life has been constantly improved, not only in

metropolis, but also in small and medium-sized cities and towns.

In the process of the construction and implementation of the project, there are some problems, such as the unsynchronized construction of urban engineering and urban lighting project, the waste of resources, the incompleteness of urban nightscape planning, and the disharmony of urban nightscape. At the same time, unreasonable lighting at night is also prone to light pollution and other issues.

With the development of network communication technology, digital technology and other modern technologies, the content and form of night lighting project in urban construction will be more abundant. In the future, the city's social economy and people's living standards will continue to improve. Night lighting project will continue to be a key project in urban construction, parallel. This also requires architectural designers and engineers in the design phase of the building, need to consider the construction of night lighting engineering, more comprehensive design and construction, to achieve more intelligent urban functions.

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