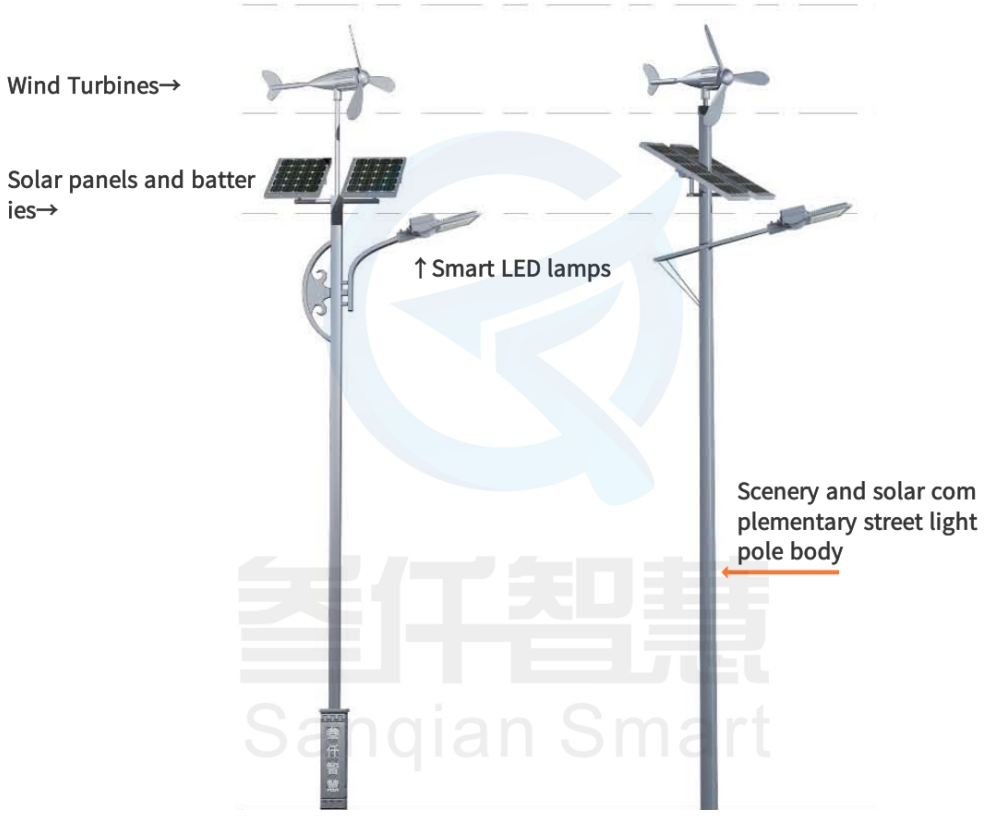
Smart Solar Street Light Planning Scheme for Factory Area Roads

In the operation of modern industrial enterprises, nighttime lighting is not only a fundamental guarantee for safe production but also an intuitive reflection of an enterprise's image and management efficiency. However, traditional municipal electric street lights often face problems such as complex wiring, high electricity costs, and difficult maintenance when applied in factory areas. Especially in newly built parks or remote factory areas, the cost of laying power infrastructure is enormous. With the maturity of new energy technologies, smart solar street lights have provided an innovative solution to this problem. They do not require trench digging and wiring, are flexible to install, operate with zero electricity costs, and possess intelligent control and remote management capabilities. But how to scientifically plan the height, spacing, quantity, and layout of street lights to meet lighting needs while achieving the unity of economy and intelligence? This article will deeply explore the systematic planning scheme of smart solar street lights for factory area roads.



I. Analysis of Factory Area Lighting Needs

Road lighting in factory areas needs to meet multiple objectives: ensuring the safety of vehicles and pedestrians at night and reducing accident risks; improving the

effectiveness of security monitoring and eliminating lighting blind spots; lowering energy consumption and operation and maintenance costs; and adapting to the complex environment of the factory area (such as the passage of heavy vehicles, dust, oil pollution, etc.). Different areas have different lighting requirements: main roads require high illumination and wide coverage; branch roads and sidewalks can have appropriately lower standards; key nodes such as loading and unloading areas and entrances/exits need to be strengthened. Therefore, planning must be based on functional zoning and adopt differentiated designs.

II. Scientific Determination of Street Light Height and Spacing

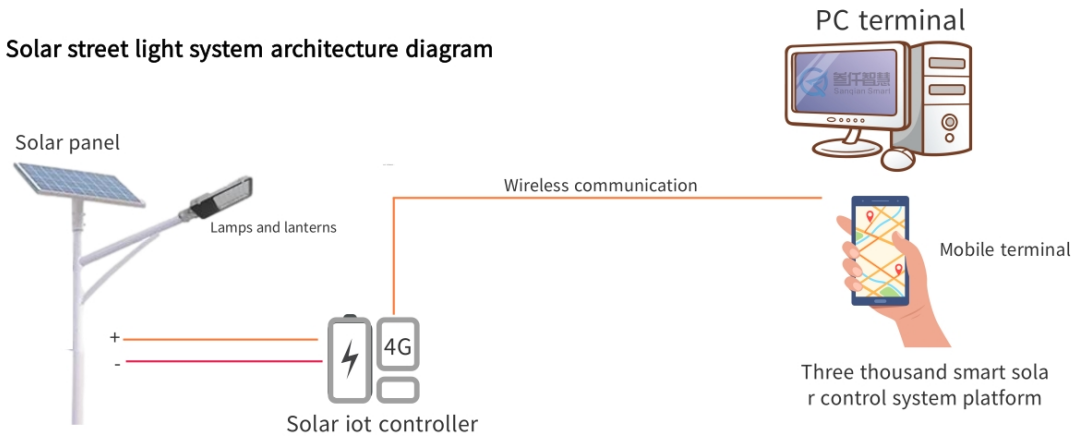
1. Selection of Light Pole Height

The height of the light pole directly affects the lighting coverage range and uniformity. If it is too low, the illumination will be concentrated and the coverage will be narrow; if it is too high, it may lead to insufficient illumination and glare. According to the characteristics of factory area roads, a height range of 4 meters to 6 meters is recommended:

- 4-meter light poles: Suitable for sidewalks, non-motorized lanes, and branch roads with a width of less than 6 meters. This height ensures that the light is close to the ground, reduces glare, and enhances pedestrian safety.

- 5-meter light poles: Suitable for main factory roads with a width of 6-8 meters. They balance the coverage range and illumination intensity, making them suitable for the passage of medium-sized vehicles.

- 6-meter light poles: Used for main roads with a width of more than 8 meters or areas with frequent passage of heavy vehicles. They ensure uniform lighting over a large area and avoid shadows caused by vehicle obstruction.



The solar street light iot control function is composed of a solar charge and discharge controller and a 4G Internet of Things module. Through the 4G I nternet of Things module, the solar charge and discharge controller is managed, so as to realize the remote switch, dimming and electrical parameter acquisition of the solar street light and other Internet of Things control functions.

2. Matching of Spacing and Light Arrangement

The spacing of light poles must be comprehensively determined based on height, lamp power, and light distribution curve. Generally, the empirical rule of "spacing = 3-4 times the lamp height" is followed:

- For 4-meter light poles, the recommended spacing is 12-16 meters, with single-sided light arrangement, which is suitable for narrow roads.

- For 5-meter light poles, the spacing is 15-20 meters. Single-sided or double-sided staggered light arrangement can be adopted to improve illumination uniformity.

- For 6-meter light poles, the spacing is 18-24 meters. Double-sided symmetrical light arrangement is recommended to ensure that the illumination at the road centerline meets the standard.

Based on the standards of the CIE (International Commission on Illumination), the average illumination of main roads in factory areas should be ⩾10 lx, and the uniformity should be ⩾0.4; for branch roads, the average illumination should be ⩾5 lx, and the uniformity should be ⩾0.3. By using professional lighting simulation software (such as DIALux) for light arrangement simulation, the feasibility of the scheme can be

accurately verified, avoiding excessive lighting or insufficient lighting.

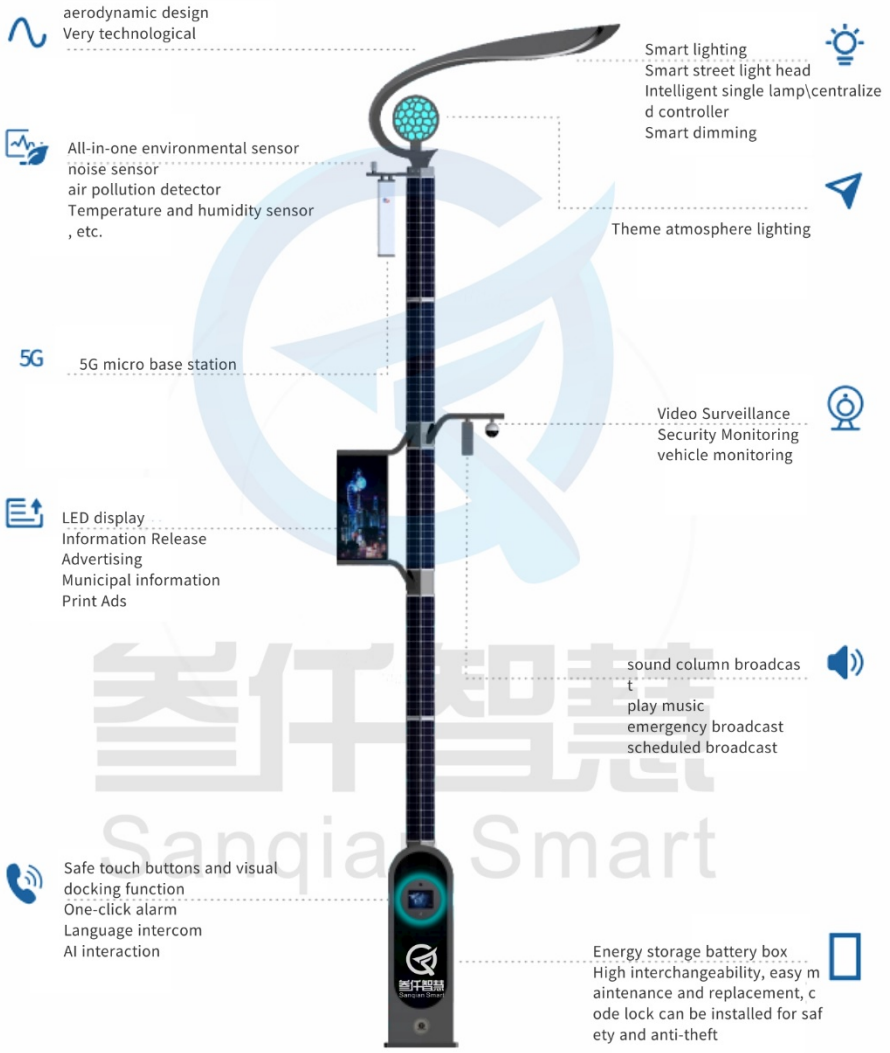
III. Street Light Quantity and Power Configuration

The number of street lights is determined by the total length of the road, the spacing of the light arrangement, and the turning nodes. For example, for a 500-meter-long main road, using 5-meter light poles, an 18-meter spacing, and double-sided light arrangement, a total of about 56 street lights are needed (28 on each side). In areas such as turns, intersections, and entrances/exits, it is necessary to increase the density of light arrangement or the power of lamps to ensure visual continuity and safe transition. The selection of lamp power needs to balance brightness and energy consumption. LED light sources are recommended:

- Main roads: 30-50W, color temperature of 4000K (neutral white light), color rendering index ⩾75, providing a clear field of vision.

- Branch roads and sidewalks: 20-30W, meeting basic lighting needs.

The configuration of the solar system must ensure power supply during consecutive rainy days. Taking a 30W lamp as an example, if it is illuminated for 10 hours a day, the power consumption is 300Wh. Equipped with a 12.8V/80Ah lithium iron phosphate battery (with a capacity of 1024Wh), it can support operation for 3 consecutive rainy days. The power of the photovoltaic panel is designed according to the principle of "daily average power generation ⩾ daily power consumption × 1.5". It is recommended to configure a 160W photovoltaic panel for a single lamp (such as a 4×40W attached design) to ensure sufficient energy supplement.



IV. Layout Scheme and Intelligent Integration

1. Zoned Layout Strategy

Divide the factory area into lighting levels:

- Level 1 areas (main roads, entrances/exits, loading and unloading areas): High poles (5-6 meters), high power (40-50W), double-sided light arrangement, high density.

- Level 2 areas (branch roads, workshop connecting roads): Medium poles (5 meters), medium power (30W), single-sided or staggered light arrangement.

- Level 3 areas (sidewalks, green belts): Low poles (4 meters), low power (20W), single-sided light arrangement.

2. Smart Function Integration

Each street light is integrated with an IoT module to realize:

- Intelligent dimming: Automatically adjust brightness according to time, light intensity, or human-vehicle induction, saving energy by more than 30%.

- Remote monitoring: The platform displays the status of each lamp in real-time, and automatically alarms for faults.

- Security linkage: Some light poles are integrated with cameras or alarm buttons to enhance security capabilities.

- Environmental monitoring: Optional PM2.5 and noise sensors can be equipped to serve the environmental management of the factory area.

V. Conclusion: Smart Lighting Empowers Modern Factory Areas

A scientifically planned smart solar street light system is not only a lighting tool but also an intelligent infrastructure that improves the safety, efficiency, and image of the factory area. By accurately determining the height, spacing, and quantity, and combining zoned layout and intelligent management, the optimal balance between lighting needs, economy, and sustainability can be achieved. With rich project experience and advanced technology, Hangzhou Sanqian Smart City Technology Co., Ltd. provides customers with one-stop solutions from planning, design to implementation and operation and maintenance. Choosing us means choosing a safer, more efficient, and greener future for the factory area. Let us work together to illuminate every step of the enterprise's development with the light of wisdom.

Technical Support

The technical solution is mainly used to guide users to better understand how to plan and design the application of smart solar street lights. If users have any unclear points during the design and planning process, please contact our company, and we will provide you with a satisfactory reply.

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