Solar Street Lights with Inbuilt CCTV

Stand-alone solar street lights provide an environmentally friendly solution and a desirable upgrade to the outdoor lighting infrastructure. It eliminates expensive cabling and removes the dependence on grid, thereby not only reducing expenses but also avoiding blackout conditions in the event of a power outage. In this article, **Dr Kushant Uppal** and **Sweta Singh** talk about the integrated solar street light with CCTV system of Intelizon, which has received acceptance in various applications. Its completely wireless lighting and surveillance feature is unique as it requires no maintenance and simplifies installation.

Safety and security while walking on the streets day and night is a citizen's right. Inadequate lighting of streets increases crime rates, leaving the individuals vulnerable. Many cases of robbery are reported every day that turn violent at times, leading to fatality. While technology has invaded our personal lives, the world of outdoor lighting continues to live on age-old infrastructure. We often see overhanging cable lines or dug up roads requiring expensive underground cabling. Separate poles are being used for lights and surveillance cameras across cities. It is common to see a mesh of power and communication cables hanging on these poles. The wires not only spoil the aesthetics of a city but are expensive to install and unreliable. We will present the case for a wireless outdoor lighting and surveillance system, which has the potential to upgrade infrastructure globally.

Challenges with Typical Solar Street Light Systems

Stand-alone solar street lights provide an environmentally friendly solution and a desirable upgrade to the outdoor lighting infrastructure. It eliminates expensive cabling (Figure 1) and removes the dependence on grid, which not only reduces the high electricity bills but also helps avoid blackout conditions in the event of a power outage. Solar street lights have been around for years, but they have been plagued with age-old lead-acid battery technology, unreliable performance during cloudy days, poor designs, and high maintenance cost.

The external lead-acid batteries are prone to theft, require multiple cable joints, and the electronics are inefficient, leading to losses and poor

Figure 1 Expensive cabling and age-old infrastructure for grid-connected street lights

charging on cloudy days when the solar output is low. Also, these batteries are unsuitable for outdoor conditions as high temperatures dry up the liquid. Recently, a spate of companies have been promoting the inbuilt panel (all in one) based solar street lights with lithium-ion batteries. These have a fundamental design issue as the solar panel has to be south facing and the light has to face the street. Given that it is a single unit, this is not possible and users have experienced backup issues related to the fundamental design flaw. The difficulties in maintenance and poor quality batteries have added to the poor performance of the all-in-one system.

Two-in-one Solar Street Light with Inbuilt Lithium-ion Batteries: Safe and Reliable Solution

Solar street lights with inbuilt lithium-ion batteries and a separate solar panel are the ideal design to provide reliable field performance. A properly designed lithium-ion battery with high-quality cells and battery management systems (BMS) matching to the charge controller and with proper thermal management is the key to long-term reliability. The best street light systems use high-quality NMC cells from Samsung, LG, or Panasonic, which are also widely used in mobile phones, laptops, and electric vehicles. These, when combined with a proper battery management system, ensure long (>2000) cycle life. Conventionally, solar street lights utilize timer-based dimming and oversized batteries to provide 1–2-day autonomy/backup on cloudy days when the solar panel output is reduced. The best-in-class solar LED street lights should have the self-autonomy feature. This ensures long backup even with extended cloudy days. Self-autonomy requires solar LED street light with inbuilt lithium-ion battery to use high efficiency (>97%) smart controllers with battery capacity-based dimming. The light intensity is reduced when the battery is partially charged, ensuring long backup hours without having to increase the battery capacity. This ensures reliable performance even if a site experiences extended (1 or 2 weeks) cloudy conditions. Intelizon's solar LED street light systems are a good example of such a design with a proven track record of over 6 years in the field and over 40,000 deployments.

Surveillance plus Lighting: New Era of Innovation

IP cameras for surveillance have become the latest trend. However, shabby cables on dedicated poles not only spoil the aesthetics but are also an unreliable solution as cable cuts are common. Also, IR LEDs provide ghostly black and white night vision, which defeats the purpose of surveillance and safety. An innovative solution to this problem is to use a solar LED street light with inbuilt CCTV module to create a wireless surveillance system. The use of ultra-low power consumption (1.2 W) camera modules enables solar panels to operate in daytime and lithium-ion batteries at night. The integration of light and cameras provides coloured night vision, which enhances security.

Solar LED Street Light with Inbuilt CCTV: System Design and Features

Figure 2 describes the system design. It has an inbuilt lithium-ion battery with an integrated 3MP camera providing 24x7 colour visions for high safety and security. This is combined with smart electronics and the self-autonomy feature for enhanced performance. The camera comes with an inbuilt memory card where one can store videos up to 30 days. The separate IP65 Hotspot box mounted on the pole includes a lithium-ion battery, charge controller, clamp, and cable wire with connectors where a hotspot device with best local 4G signals can be inserted for remote connectivity. The system provides remote live video and playback on smartphones as well as on desktop via application software which comes with the system. The playback feature on the application software provides users the ability to monitor the location from the comfort of their mobile phone sitting anywhere in the world. The separate IEC certified solar panel with more than 25 years of life ensures efficient battery charging.

The solar LED street light plus surveillance system with an integrated CCTV, lithium-ion battery, advanced electronics, WIFI/4G, and LED technology provides many benefits. Some of the benefits are (i) savings on power cables, (ii) savings on communication cables, (iii) savings on additional poles, (iv) superior security as night images are coloured and visually clearer, and (v) prevention of theft as there is no way to know there is a

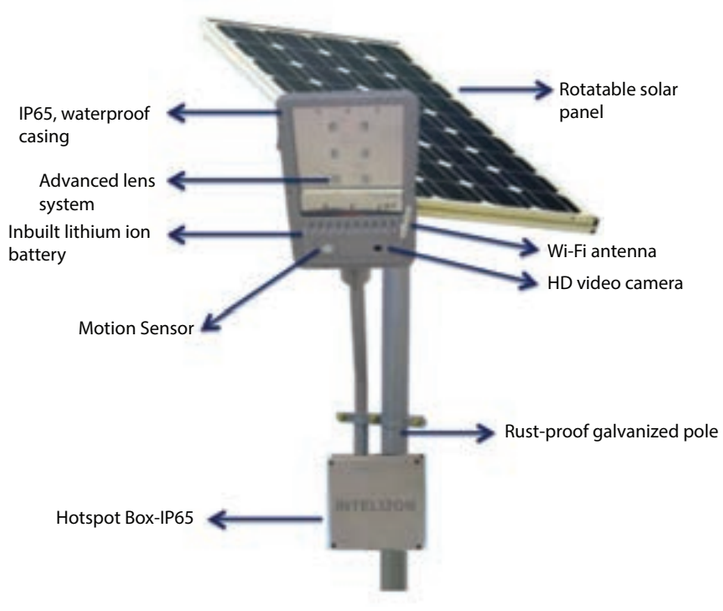

Figure 2 Solar LED street light plus CCTV system design (inbuilt camera, sensor, and battery with solar panel and hotspot)

Figure 3 Solar LED street light with inbuilt CCTV at a railway crossing in Jaipur (left) and inbuilt camera vision (right)

camera and the possibility of bypassing it or cutting cables does not exist.

Impact and Performance

Intelizon has pioneered the integrated solar street light with CCTV system, which has received acceptance in various applications. The Rajasthan railways recently installed the Zonstreet CCTV 30 W LED solar street light for surveillance and safety at their crossings. Most of the manned crossings do not have a remote monitoring facility. These systems provide not only wireless lighting but also remote surveillance. This allows the authorities to provide safety for citizens in remote locations and the surveillance data improves security. The completely wireless lighting and surveillance feature is unique as it requires no maintenance and simplifies installation. The BIS, UL, and NABL certified 30 W CCTV solar LED street lights (Figure 3) provide the state-of-the-art highest light output per watt (>160 lumen/W) LEDs (LM80 certified) and have a terrific aesthetic appeal with the use of reflectors and lenses.

The separate solar panel allows proper mounting at an angle depending on the latitude of the location where light is to be installed. Proper panel mounting angle ensures good charging during cloudy/winter seasons while preventing dust accumulation. This required a lot of design optimization and has resulted in a unique solution with global appeal.

Conclusion

Imagine a world where there is no dependence on cables and on-grid power while providing security anytime anywhere. Can there be a better solution for smart cities globally? Intelizon's game-changing solution inbuilt CCTV-based solar LED street light has created such a possibility while impacting over 2.6 million lives, saving over 24 million units of electricity, and contributing to more than 17,000 metric tons of CO_2 emission reductions. We hope this sets the trend and will change the world of outdoor lighting forever. EF

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