

SOLAR POWERED STREET LIGHTING SYSTEM

Field of the Invention

[0001] The present invention generally relates to street lighting technology, and in particular, to a solar powered street lighting system.

Background of the Invention

[0002] Landscape lighting has long been popular as illumination enhancement at night. Conventional street lighting systems require running wires underground for electrical power supply, and typically employ incandescent tungsten filament lamps as light sources. The installation of underground wires is time consuming and costly. Incandescent bulbs are inefficient, because most of electrical power supplied is dissipated as heat. And the standard height of street lights falls outside the range of illumination adequacy of most incandescent bulbs.

[0003] Light emitting diodes (LEDs) are now being widely used as low cost alternative light sources to the incandescent bulbs, for its considerably lower energy consumption and high luminescence. However, to employ LEDs in street lighting system, one technical barrier remains -the dissipation of mass heat generated in the course of operation of the light-emitting chip of the LED. Without an effective heat dissipating means, the accumulating mass heat greatly shortens the life span of the LED and even affects the overall reliability of the whole street lighting system.

[0004] Furthermore, due to the shortage of fuel, there has been increased interest in the use of solar power as alternative energy source for fossil fuels. The concept of utilizing sunlight as power source for the street lighting system has been introduced. However, the implementation of the concept encounters several problems. The construction cost of a solar power generator remains high. And due to inefficient energy conversion, excessive number of photovoltaic cells is required to meet certain energy supply. In addition, solar power generators are prone to wear and tear, in particular under harsh weathers, such as sandstorm, raining and snowing. The expense for frequent maintenance and repair further contributes to its operational cost.

[0005] In view of the above-mentioned problems, there is a need for a new generation of street lighting system powered by cost effective, high energy saving and durable solar power generator, and equipped with highly efficient heat dissipation solution.

Summary of the Invention

[0006] The present invention provides a street lighting system, which comprises a pole; a solar power generator mounted on the pole for converting solar radiation into electrical energy; a rechargeable storage battery electronically connected to the solar power generator for receiving, storing and outputting the generated electrical energy; a lighting module extending from the pole and powered by the rechargeable storage battery; a solar tracking sensor for determining the relative orientation of the solar concentrator to the incident sunlight; a day/night sensor for detecting the transition from day to night; a rain/snow sensor for detecting rainfall and snowfall; and a position controller for receiving and processing the signals from the solar tracking sensor, day/night sensor and rain/snow sensor, and adjusting the orientation of the solar power generator accordingly.

[0007] According to one aspect of the invention, there is provided a street lighting system, wherein the solar power generator comprises a solar concentrator; a photovoltaic module mounted on the solar concentrator; and a mechanical drive module connected to the solar concentrator for adjusting the orientation thereof in the horizontal and vertical directions pursuant to the instructions from the positional controller.

[0008] According to another aspect of the invention, there is provided a street lighting system, wherein the position controller in response to the signal from the solar tracking sensor, is operable to actuate the mechanical drive module, so that the solar concentrator remains oriented towards the sun during the day.

[0009] According to yet another aspect of the invention, there is provided a street lighting system, wherein the position controller is operable to actuate the mechanical drive module to rotate the solar concentrator to a first pre-determined position and to stop the solar tracking, when the day/night sensor signals the transition from day to night.

[0010] According to further another aspect of the invention, there is provided a street lighting system, wherein when the rain/snow sensor signals rainfall/snowfall, the position controller is operable to actuate the mechanical drive module to rotate the solar

concentrator to a second pre-determined position, so that the components mounted on the solar concentrator are shielded from the rain/snow.

[0011] According to another aspect of the invention, there is provided a street lighting system, wherein the lighting module comprises at least one light source; a supporting plate for holding the at least one light source and transferring away the heat generated by the light source in operation; and at least one heat transfer tube having one end in contact with the supporting plate and the other end connected to the pole for heat conducting and dissipating.

[0012] According to yet another aspect of the invention, there is provided a street lighting system, which further comprises a first light sensor for measuring the intensity of sunlight; a second light sensor for measuring the intensity of combined light from the sun and the lighting module; and a light controller for receiving signals from the first and second light sensors, and regulating the optical output of the lighting module.

[0013] According to further another aspect of the invention, there is provided a street lighting system, which further comprises a vandal proof container for housing the rechargeable storage battery.

[0014] The objectives and advantages of the present invention will become apparent from the following detailed description of embodiments thereof in connection with the accompanying drawings.

Brief Description of the Drawings

[0015] Preferred embodiments according to the present invention will now be described with reference to the Figures accompanied herein, in which like reference numerals denote like elements.

[0016] FIG. 1 shows a side view of a solar powered street lighting system in accordance with one embodiment of the present invention.

[0017] FIG. 2 shows a cross sectional view of the lighting module as shown in FIG. 1 in accordance with one embodiment of the present invention.

[0018] FIG. 3 shows a top broken section view of the lighting module as illustrated in FIG. 1.

[0019] FIG. 4 shows a cross sectional front view of the lighting module as illustrated in FIG. 3.

[0020] FIG. 5 shows a front view of the solar power generator as illustrated in FIG. 1.

[0021] FIG. 6 shows a side view of the solar power generator as illustrated in FIG. 1.

[0022] FIG. 7 shows a circuit diagram of the position controller in accordance with one embodiment of the present invention.

[0023] FIG. 8 shows a side view of the vandal proof container in accordance with one embodiment of the present invention.

Detailed Description of the Invention

[0025] The present invention may be understood more readily by reference to the following detailed description of certain embodiments of the invention.

[0026] Now referring to FIG. 1, there is provided a side view of a solar powered street lighting system in accordance with one embodiment of the present invention. The street lighting system **100** comprises an upright pole **1**, a lighting module **2** extending from the pole **1**, a light reflector **3** above the lighting module **2**; a light controller **4** for controlling the output of the lighting module **2**; a solar power generator **5** mounted on top of the pole **1**, a position controller **6** for regulating the orientation of the solar power generator **5**; a rechargeable storage battery **7** electronically connected to the solar power generator **5**, a charge controller **8** for regulating the charging/discharging status of the rechargeable storage battery **7**; and a sensing system **9** for detecting irradiance and ambient conditions and sending signals to the light controller **4** and position controller **6**.

[0027] The upright pole **1** is secured to a base **11** via a plurality of brackets **12**. A first **13** and a second **14** supporting arms extend from the side of the pole **1**, and hold the lighting module **2** and the light reflector **3** respectively. Now referring to FIG 2, 3 and 4, there are provided details of the lighting module **2** in accordance with one embodiment of the present invention. FIG. 2 is a cross sectional view of the lighting module **2** in FIG.1; FIG. 3 a top broken section view; and FIG. 4 a cross sectional front view of the lighting module **2** in FIG. 3. The lighting module **2** has a transparent or translucent light housing

21, a supporting plate 22 with arrays of recesses 23 on both upper and lower surfaces, a plurality of light sources 24 disposed therein; and a bundle of heat transfer tubes 25 with one end in contact with the supporting plate 22 and the other end extending along the hollow inner chamber of the first supporting arm 13 and connected to the pole 1 (not shown in FIG. 4). In operation, when the light sources 24 are powered, mass heat generated is rapidly transferred to the supporting plate 22, then conducted to the heat transfer tubes 25, further transmitted down to the pole 1, and eventually dissipated into the air.

[0028] As shown in FIG. 2 and 4, the supporting plate 22 is composed of two halves, with the bundle of heat transfer tubes 25 disposed in between forming heat exchange contact. For optimal heat transmission, the inner surfaces of the supporting plate 22 are non-planar, and the heat transfer tubes 25 are configured accordingly so as to maintain the tight heat exchange contact. In one embodiment, the inner surfaces are in a wavy configuration. In another embodiment, the inner surfaces are in a stair-shape configuration.

[0029] To further facilitate heat dissipation, the heat transfer tubes 25 may have a plurality of through holes drilled on the side. And for protection purpose, the part of heat transfer tubes 25 extending out of the supporting plate 22 may be disposed in a sheath that has a plurality of through holes on the side for heat dissipation. In one embodiment, the sheath is made of steel.

[0030] The supporting plate 22 is preferably made of material of high thermal conductivity and proper electrical insulation. In one embodiment, the supporting plate 22 is made of graphite. However, it is understood by the person skilled in the art that other suitable materials may be used.

[0031] The heat transfer tubes 25 are preferably made of high thermal conductive material. In one embodiment, the heat transfer tubes 25 are made of copper. In another embodiment, the heat transfer tubes 25 are made of aluminum.

[0032] In one preferred embodiment of the light sources, the light sources 24 are LEDs. In another embodiment, the light sources are fluorescent light bulbs. In yet another embodiment, the light sources are high intensity discharge (HID) lamps. In further another embodiment, the light sources are incandescent light bulbs.

[0033] Referring back to FIG. 1, the light reflector 3 is installed at one end of the second supporting arm 14 and located above the lighting module 2 for reflecting light towards the ground. In one embodiment, the first supporting arm 13 is in an arch-shape configuration whilst the second supporting arm 14 is in an S-shape configuration. The turning point of the S-shaped second supporting arm 14 rests upon the first supporting arm 13, and the contact is stabilized by a connector 15 so that the relative position of the light reflector 3 to the lighting module 2 is maintained for optimal reflection pattern.

[0034] Still referring to FIG. 1, the optical output of the light sources 24 is regulated by the light controller 4 in response to a first 91 and second 92 light sensor of the sensing system 9. The first light sensor 91 is installed on top of the pole 1 for measuring the intensity of sunlight, while the second light sensor 92 at the side of the pole 1 close to the ground for measuring the intensity of combined light from the sun and the lighting module 2. The input terminal of the light controller 4 is electrically connected to the first 91 and second 92 light sensors, and the output terminal connected to the light sources 24. In operation, when the light intensity detected by the first light sensor 91 is lower than a pre-determined threshold, the light controller 4 sends a signal to switch on the light sources 24. The optical output of the light source 24 is automatically and continuously regulated according to the input signal from the second light sensor 92, for energy saving purpose.

[0035] In one embodiment of the light sensors, the first 91 and second 92 light sensors are light dependent resistors.

[0036] Now referring to FIG. 5 and 6, there are provided a front view and a side view of the solar power generator 5 as shown in FIG. 1 respectively. Mounted on a fixing base 16 at the upper end of the pole 1, the solar power generator 5 comprises a solar concentrator 51 for collecting and concentrating solar radiation, a photovoltaic module 52 for converting the received radiation energy to electric power, and a mechanical drive module 53 for regulating the orientation of the solar concentrator 51 per instructions from the positional controller 6.

[0037] The solar concentrator 51 is pivotally connected via a hinge 58 to one end of a support shaft 56. The other end of the support shaft 56 is rotably mounted on the fixing base 16 via an inclined connector 57. The solar concentrator 51 has a frame 511 and a plurality of reflective mirrors 512 disposed thereon. Between each two adjacent reflective

mirrors 512, there is a gap 513 for breaking the flow of the air over the surface of the reflective mirrors 512, thereby reducing the impact of tangential force thereon.

[0038] In one embodiment of the frame, the frame 511 is arch-shaped as shown in FIG. 5. In another embodiment, the frame 511 is semi-spherical.

[0039] The photovoltaic module 52 is composed of a plurality of photovoltaic cells 521 disposed on a support member 522, and is connected to the rechargeable storage battery 7 (not shown in FIG. 5 and 6) via wires. The photovoltaic cells 521 are preferably located at the focal line of the solar concentrator 51, with the light receiving surfaces facing the reflective mirrors 512.

[0040] In one embodiment, the photovoltaic cells 520 are preferably of the configuration disclosed in Chinese Patent Application No. 200310103395.X.

[0041] The mechanical drive module 53 comprises a worm gear set 54 and a connecting bolt and nut set 55. The worm gear set 54 includes a first reversible motor 541 secured on a side of the support shaft 56, a worm 542 connected to the output end of the motor 541, and a worm wheel 543 (not shown in FIG. 5 and 6) meshing with the worm 542 and coaxially installed on the support shaft 56. The actuation of the first reversible motor 541 controls the rotation of the support shaft 56, which in turn regulates the position of the solar concentrator 51 in the horizontal orientation. The connecting bolt and nut set 55 includes a second reversible motor 551 secured on a side of the support shaft 56, a rod bolt 552 coupled to the output end of the second reversible motor 551, and a nut 553 engaged with the bolt 552 and connected to the frame 511. The actuation of the second reversible motor 551 controls the relative position of the bolt 552 to the nut 553, thereby adjusting the vertical orientation of the solar concentrator 51 with respect to the support shaft 56.

[0042] The mechanical drive module 53 is actuated by the position controller 6 in response to signals from sensors of the sensing module 9. The sensors include four solar tracking sensors 93, a day/night sensor 94, and a rain/snow sensor 95.

[0043] Now referring to FIG. 1, the solar tracking sensor 93 is installed on one side of the support member 522, perpendicular to the solar concentrator 51, for measuring irradiance from the sun during a day. The solar tracking sensor 93 has four light sensors 93a, 93b, 93c and 93d, signals generated by which cooperatively indicate the relative position of the solar concentrator 51 to the incident sunlight.

[0044] The day/night sensor 94 is installed on top of the pole for detecting the transition from day to night. In one embodiment, the day/night sensor 94 is a light dependent resistor. In another embodiment, the day/night sensor 94 is a photoelectric sensor.

[0045] In addition, the rain/snow sensor 95 is provided for detecting exposure to fluid so as to identify rainfall/snowfall. In one embodiment, the rain/snow sensor 95 is a fluid electrode. In another embodiment, the rain/snow sensor 95 is a temperature and humidity detector.

[0046] Now referring to FIG. 7, there is provided a circuit diagram of the position controller 6 in accordance with one embodiment of the present invention. The position controller 6 has four sub-circuits 61a, 61b, 61c, and 61d for controlling the orientation of the solar concentrator 51 in relation to the east, west, south and north directions respectively. The input terminal of each sub-circuit 61 is connected to one of the solar tracking light sensors 93a, 93b, 93c or 93d in the corresponding direction. The output terminals of the sub-circuits 61a and 61b are connected to the first reversible motor 541 for cooperatively controlling the on/off status and rotation direction thereof. Likewise, the output terminals of the sub-circuits 61c and 61d are connected to the second reversible motor 551. Each sub-circuit 61 further includes a constant voltage DC power supply; a signal regulating circuit for selectively transmitting and amplifying input signals, and outputting a regulated signal; and a logic circuit for processing the regulated signal and sending an output signal to the corresponding reversible motor 541 or 551.

[0047] In the embodiment as shown in FIG. 7, each light sensor 93a, 93b, 93c or 93d is composed of an infrared photodiode PD and a photo coupler PC. And each logic circuit includes a plurality of diodes D and a transistor Q for signal processing, a reply J for actuating the rotation of the reversible motor 541 or 551, and a positioning transducer K for halting the rotation of the reversible motor 541 or 551 once the solar concentrator 51 reaches a pre-determined limit position.

[0048] In view of the similarity in operation principles of the sub-circuits 61 for solar tracking, only the ones for adjusting the horizontal position of the solar concentrator 51 are described herein. When only the photodiode PD1 is incidentally illuminated, indicating the misalignment of the solar concentrator 51 with the incident sunlight, the photo coupler PC1 is conducted due to the dramatically reduced resistance of the

photodiode PD1. Sequentially, the transistor Q1 is saturated; the relay J1 is energized; and the first reversible motor 541 is switched on to rotate in a first direction. As a result, the solar concentrator 3 is re-directed towards the incident sunlight. Likewise, when only the photodiode PD2 is illuminated, the relay J2 is energized and the relay J1 remains de-energized. Consequently, the first reversible motor 541 is switched on to rotate in a second direction. When the solar concentrator 51 is in alignment with the sunlight, both of the photodiodes PD1 and PD2 are of low resistance. Hence, both of the relays J1 and J2 are energized, which switches off the first reversible motor 541.

[0049] Still referring to FIG. 7, in this embodiment, the day/night sensor 94 is a light dependent resistor LDR, which is connected to the sub-circuit 61a via a day/night differentiation circuit 65. The day/night differentiation circuit 65 also includes the position transducer K1, and a photo coupler PC5. In operation, when the ambient light intensity reduces, the resistance of the light dependent resistor LDR rises. Once the resistance thereof exceeds a pre-determined value, the photo coupler PD5 is conducted, indicating the transition of day to night. Sequentially, the transistor Q1 is saturated, which causes the first reversible motor 541 to rotate in the first direction so as to direct the solar concentrator 51 towards the east. Once the solar concentrator 51 reaches the pre-determined limit position, the position transducer K1 is conducted, so that the first reversible motor 541 is halted.

[0050] In addition, the rain/snow sensor 95 is connected to the sub-circuit 61c for signaling. In this embodiment, the rain/snow sensor 95 is a fluid electrode R. During rainfall/snowfall, the fluid flowing over the surface of the fluid electrode R triggers an electric signal, which actuates the rotation of the second reversible motor 551 to turn the solar concentrator 51 downward, thereby reducing the chances of damage to the components mounted on the solar concentrator 51.

[0051] Now referring back to FIG. 1, the rechargeable storage battery 7 is disposed in a vandal proof container 18 housed in the base 11. The charging/discharging status of the rechargeable storage battery 7 is monitored by the charge controller 8, which is connected with the photovoltaic module 52 and the light sources 24 to form a complete control circuit. The charge controller 8 is disposed in the inner chamber of the pole 1, accessible by unlocking and opening the door 17 on a side of the pole 1.

[0052] Now referring to FIG. 8, there is provided a side view of the vandal proof container 18 in accordance with one embodiment of the present

invention. The container **18** has a base **181** defining an inner hollow chamber **182**, and a lid **183** removably sealed to the base **181** via pairs of bolts **184** and nuts **185**. The bolt heads faces the inner chamber **182**. At least one slit **186** of pre-determined dimensions is carved at the upper part of the sidewalls of the base **181**, so that only screwing tools **187** of a matching size can pass through the slit **186** to engage with the bolt heads and fasten or unfasten the bolts **184**.

[0053] In one embodiment, the container **18** is in a rectangular shape. In another embodiment, the container **18** is in a circular shape.

[0054] While the present invention has been described with reference to particular embodiments, it will be understood that the embodiments are illustrative and that the invention scope is not so limited. Alternative embodiments of the present invention will become apparent to those having ordinary skill in the art to which the present invention pertains. Such alternate embodiments are considered to be encompassed within the spirit and scope of the present invention. Accordingly, the scope of the present invention is described by the appended claims and is supported by the foregoing description.

Claims

1. A street lighting system comprising:
 - a pole;
 - a solar power generator mounted on the pole for converting solar radiation into electrical energy, which comprises a solar concentrator, a photovoltaic module mounted on the solar concentrator, and a mechanical drive module connected to the solar concentrator for adjusting the position thereof;
 - a rechargeable storage battery electronically connected to the solar power generator for receiving, storing and outputting the electrical energy generated;
 - a lighting module extending from the pole and powered by the rechargeable storage battery;
 - a solar tracking sensor for determining the relative orientation of the solar concentrator to the incident sunlight;
 - a day/night sensor for detecting the transition from day to night;
 - a rain/snow sensor for detecting rainfall and snowfall; and
 - a position controller for receiving and processing the signals from the solar tracking sensor, day/night sensor and rain/snow sensor, and actuating the mechanical drive module.
2. A street lighting system of claim 1, wherein the solar tracking sensor comprises four light sensors, corresponding to the east, west, south and north direction respectively.
3. A street lighting system of claim 2, wherein each light sensor comprises an infrared photodiode and a photo coupler.
4. A street lighting system of claim 1, wherein the position controller is operable to actuate the mechanical drive module in response to the signal from the solar tracking sensor, so that the solar concentrator remains oriented towards the sun during the day.
5. A street lighting system of claim 1, wherein the day/night sensor is a light dependent resistor.

6. A street lighting system of claim 1, wherein the position controller is operable to actuate the mechanical drive module to rotate the solar concentrator to a first pre-determined position, when the day/night sensor signals the transition from day to night.
7. A street lighting system of claim 6, wherein the solar concentrator faces the east when rotated to the first pre-determined position.
8. A street lighting system of claim 1, wherein the rain/snow sensor is a fluid electrode.
9. A street lighting system of claim 1, wherein the rain/snow sensor is a humidity sensor.
10. A street lighting system of claim 1, wherein the position controller is operable to actuate the mechanical drive module to rotate the solar concentrator to a second pre-determined position, when the rain/snow sensor signals rainfall/snowfall.
11. A street lighting system of claim 10, wherein the solar concentrator faces downward when rotated to the second pre-determined position.
12. A street lighting system of claim 1, wherein
 - the solar power generator further comprises a support shaft having one end rotably mounted onto the pole and the other end pivotally connected with the solar concentrator; and
 - the mechanical drive module is operable to rotate support shaft and pivot the solar concentrator with respect to the support shaft, in order to adjust the position of the solar concentrator in the horizontal and vertical orientation respectively.
13. A street lighting system of claim 12, wherein the mechanical drive module has a worm gear set for rotating the support shaft, which comprises:
 - a worm wheel co-axially disposed around the support shaft;
 - a worm meshing with the worm wheel; and

a reversible motor for driving the rotation of the worm.

14. A street lighting system of claim 12, wherein the mechanical drive module has a bolt nut set for pivoting the solar concentrator with respect to the support shaft, which comprises:
 - a reversible motor attached to the support shaft;
 - a bolt connected to the output end of the reversible motor; and
 - a nut engaged with the bolt and pivotally connected to the solar concentrator.
15. A street lighting system of claim 12, wherein the position controller comprises:
 - a first and a second sub-circuits for outputting signals to the mechanical drive module to actuate the position adjustment of the solar concentrator in the horizontal orientation; and
 - a third and a fourth sub-circuits for outputting signals to the mechanical drive module to actuate the position adjustment of the solar concentrator in the vertical orientation;wherein:
 - the day/night sensor is electrically connected to one of the first or second sub-circuits;
 - the rain/snow sensor is electrically connected to one of the third or fourth sub-circuits; and
 - the solar tracking sensor is electrically connected to each sub-circuit.
16. A street lighting system of claim 15, wherein each sub-circuit comprises:
 - a power supply;
 - a signal regulating circuit for selectively transmitting and amplifying signals from the electrically connected sensors and generating a regulated signal; and
 - a logic circuit for receiving and processing the regulated signal and sending output signal to the mechanical drive module.
17. A street lighting system of claim 1, wherein the lighting module comprises:

- at least one light source,
 - a supporting plate for holding the at least one light source and transferring away the heat generated by the light source in operation, and
 - at least one heat transfer tube having one end in contact with the supporting plate and the other end connected to the pole for heat conducting and dissipating.
18. A street lighting system of claim 17, wherein the at least light source is LED.
19. A street lighting system of claim 17, wherein the at least light source is fluorescent light.
20. A street lighting system of claim 17, wherein the at least light source is high intensity discharge lamp.
21. A street lighting system of claim 17, wherein the at least light source is incandescent light bulb.
22. A street lighting system of claim 17, wherein the supporting plate is made of high thermal conductive material.
23. A street lighting system of claim 22, wherein the supporting plate is made of graphite.
24. A street lighting system of claim 17, wherein the at least one heat transfer tube is made of high thermal conductive material.
25. A street lighting system of claim 24, wherein the at least one heat transfer tube is made of metal.
26. A street lighting system of claim 25, wherein the at least one heat transfer tube is made of copper.

27. A street lighting system of claim 26, wherein the at least one heat transfer tube is made of aluminum.
28. A street lighting system of claim 17, wherein the supporting plate is composed of two halves, with the at least one heat transfer tube disposed in between.
29. A street lighting system of claims 17, wherein the at least one heat transfer tube has a plurality of through hole at side for enhancing heat dissipation.
30. A street lighting system of claim 17, wherein part of the at least on heat transfer tube extending out of the supporting plate is housed in a sheath.
31. A street lighting system of claim 30, wherein the sheath is made of steel.
32. A street lighting system of claim 30, wherein the sheath has a plurality of through holes at side for enhancing heat dissipation.
33. A street lighting system of claim 17, wherein the lighting module further comprises a transparent or translucent light housing in which the at least light source, the supporting plate and the at least heat transfer tube is disposed.
34. A street lighting system of claim 1, which further comprises a light reflector located over the lighting module for reflecting the light emitted therefrom.
35. A street lighting system of claim 1, which further comprises
 - a first light sensor for measuring the intensity of sunlight;
 - a second light sensor for measuring the intensity of combined light from the sun and the lighting module; and
 - a light controller for receiving signals from the first and second light sensors, and regulating the optical output of the lighting module accordingly.
36. A street lighting system of claim1, wherein the solar concentrator comprises

a frame; and
a plurality of reflecting mirrors disposed on the frame;
wherein there is a gap between each two adjacent reflecting mirrors.

37. A street lighting system of claim 1, wherein the photovoltaic module comprises at least one photovoltaic cells, which has the configuration as claimed in Chinese Patent Application Number 200310103395.X.

38. A street lighting system of claim 1, which further comprises a charge controller for regulating the charging and discharging of the rechargeable storage battery.

39. A street lighting system of claim 1, which further comprises a vandal proof container for housing the rechargeable storage battery.

40. A street lighting system of claim 39, wherein the vandal proof container comprises:
a base defining an inner hollow chamber, and having at least one slit on the side;
and
a lid removable sealed to the base from inside by pairs of bolts and nuts;
wherein the dimension of the slit is so configured as to allow only a specific screw tool with matching size to pass through and access to the inner chamber for fastening or unfastening the bolts and nuts.