

LED TRAFFIC BILLBOARD

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to the structure of LED billboards, and more particularly to an LED traffic billboard applied in the field of traffics for controlling the light emitting range effectively to achieve the effects of high directionality and low power as well as providing a highly waterproof effect.

Description of the Related Art

[0002] For the objective of providing information to pedestrians, traffic billboards showing the information such as road/street names, mileage, traffic signs, etc are generally installed at roadsides. For example, some of the common traffic billboards are hard board structures or in form of light emitting elements arranged into the desired display information, wherein the hard billboard includes related traffic information printed on a plane on a side of the billboard directly, and a reflective or luminous material is added onto the billboard when needed for enhancing the indication effect in a poor vision environment. However, the information given by the billboards of this sort cannot be changed flexibly. If it is necessary to change the display content, then another new information billboard will be required. Therefore, these billboards have very low practicality and convenience and incur a much-higher cost. In addition, these billboards may be affected by strong light easily, and reflections caused by a stronger sunlight in daytime will affect pedestrians from watching the billboards.

[0003] Therefore, a light board composed of a plurality of light emitting elements for showing information is generally used at present, and the light board comprises a light emitting module, a carrying frame and a lampshade, wherein the

light emitting module includes a plurality of LED elements in a circular arc shape which is protruded outwardly, and the light emitting module is clamped between the carrying frame and the lampshade and integrally formed with the carrying frame and the lampshade, and the light generated by the light emitting module is emitted from the lampshade to the outside, and the light emitting status of the light emitting module is controlled to arrange a desired graphic and/or text provided for being viewed by pedestrians. Although the light board is more convenient than the aforementioned billboard for changing the displayed information, the light will be in a status of having almost total reflection and the pedestrians will be unable to view the displayed information when sunlight or external strong light shines on the light board. In addition, the LED element of the light emitting module is a light source with directionality, so that if the directionality of the light is not processed appropriately, the light emitting angle of the light emitted to the outside through the lampshade having a smooth surface will be affected and scattered to reduce the contrast of the light, and thus resulting in unclear illumination. In addition, the conventional light board is integrally formed, and the light board is generally installed on a roadside or constructed at the top of a road, so that the waterproof performance is an essential design element for electronic products to prevent the light emitting module from being damaged by wind and rain in an outdoor environment. To achieve the waterproof effect, the conventional light board requires filling gaps with adhesives in order to prevent water or external moisture from entering into the light board or affecting electronic devices. If the light board is damaged, it is necessary to remove the adhesives layer by layer for inspection, maintenance, and repair.

[0004] Therefore, the inventor of the present invention designed and developed an LED traffic billboard, in hope of overcoming the drawbacks of the conventional billboards effectively.

SUMMARY OF THE INVENTION

[0005] In view of the aforementioned problems of the prior art, it is a primary objective of the present invention to provide an LED traffic billboard installable to a roadside for displaying information for the pedestrians, and the present invention has a high directionality, and the light emitting range is limited to achieve the effects of enhancing the light emitting efficiency, preventing viewers beyond the range of the light emitting angle from being affected by shadows, reducing the power loss, and extending the service life.

[0006] Another objective of the present invention is to provide an LED traffic billboard free of a locking structure free, and having the waterproof plastic strip and the hydrophobic nano plastic layer, so as to enhance the water resistance effectively, and prevent external moisture from entering from gaps of the LED traffic billboard.

[0007] To achieve the aforementioned objective, the present invention provides an LED traffic billboard, comprising a frame, a light emitting module and a lens hood, and the frame being sheathed on the light emitting module, and the lens hood being covered onto the light emitting module, characterized in that the light emitting module comprises a plurality of light emitting units arranged into a matrix, each having at least one surface mount device (SMD) LED, and the external surface of the lens hood has a serrated structure; a lens tray is coupled to a side of the lens hood, and the lens tray is integrally formed with the lens hood, and the lens tray has a plurality of lens units correspond to the light emitting units and covered onto the LEDs respectively, and the external surface of each lens unit has a microstructure, such that each LED has an illumination range of a first angle and a second angle on a Y-axis and an X-axis of a surface of the lens hood respectively, and each microstructure is a serrated surface or a wavy surface disposed perpendicular to the serrated structure.

[0008] Wherein, the external surface of each lens unit parallel to the X-axis forms a baseline, and the external surface of each lens unit is divided into two areas, and at least one area of the external surface of each lens unit is tilted from the

baseline towards a surface of the lens tray or tilted with respect to a surface of the lens tray and has a predetermined thickness, and each microstructure has a cross-section substantially in a continuously bending conical shape or circular arc shape. In addition, each lens unit has a spherical surface corresponsive to the LEDs, and after lights of the LEDs are projected onto the lens units, the tilted external surface of the lens units keeps the light within an illumination range of the first angle illumination range.

[0009] To cope with different visible distance of the pedestrians, the light emitting units are equidistantly arranged with an interval apart from one another and formed into a matrix, wherein the interval is greater than or equal to 10 millimeters and smaller than or equal to 35 millimeters.

[0010] To reduce the light emitting range of the LED traffic billboard effectively, the first angle is to 15° , and the second angle is 30° .

[0011] To enhance the waterproof effect of the LED traffic billboard, the frame includes at least one waterproof plastic strip installed around the periphery of the frame, and the circuit board of the light emitting module is covered by a hydrophobic nano plastic layer. The frame is coupled to the lens hood through a post-installation method, so that the surface of the lens hood is free of locking holes to enhance water resistance.

[0012] In another preferred embodiment, each light emitting unit is formed by three LEDs arranged into a substantially triangular shape, and the LEDs have a same color temperature or different color temperatures, and each lens unit is configured to be corresponsive to the light emitting unit and has three lenses arranged into a substantially triangular shape in order to provide diversified light emitting effects and modes.

[0013] With the aforementioned technical characteristics, the LED traffic billboard of the present invention restricts the range of a light emitting angle effectively, so that the invention can provide clear displayed information within a specific light emitting range in a very high light emitting efficiency and also can

reduce the light emitting efficiency to decrease the production of heat, so as to extend the service life effectively. In addition, the frame free of locking structure, the waterproof plastic strip and the hydrophobic nano plastic layer further enhance the water resistance of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is an exploded view of a preferred embodiment of the present invention;

[0015] FIG. 2 is a perspective view of a preferred embodiment of the present invention;

[0016] FIG. 3 is a side of a preferred embodiment of the present invention;

[0017] FIG. 4 is a cross-sectional view of Section A-A (X-axis) of a preferred embodiment of the present invention;

[0018] FIG. 5 is a cross-sectional view of Section B-B (Y-axis) of a preferred embodiment of the present invention;

[0019] FIG. 6 is an exploded view of another implementation mode of a preferred embodiment of the present invention;

[0020] FIG. 7 is a cross-sectional view of another implementation mode of a lens unit of a preferred embodiment of the present invention; and

[0021] FIG. 8 is a cross-sectional view of another implementation mode of a lens unit of a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] The aforementioned and other objectives, technical characteristics and advantages of the present invention will become apparent with the detailed description of preferred embodiments and the illustration of related drawings as follows.

[0023] With reference to FIGS. 1 to 5 for an exploded view, a perspective view, a perspective view, a side view, a cross-sectional view of section A-A (X-axis)

and a cross-sectional view of section B-B (Y-axis) of an LED traffic billboard in accordance with a preferred embodiment of the present invention respectively, the LED traffic billboard 1 comprises a frame 10, a light emitting module 11 and a lens hood 12. The frame 10 is sheathed and coupled to the light emitting module 11, and the lens hood 12 is covered onto the light emitting module 11.

[0024] The LED traffic billboard 1 is characterized in that the light emitting module 11 includes a plurality of light emitting units 111 arranged into a matrix each having at least one surface mount device (SMD) LED 1111, and the external surface of the lens hood 12 has a serrated structure 121, and one side of the lens hood 12 is coupled to a lens tray 122, and the lens tray 122 is integrally formed with the lens hood 12 and configured to be corresponsive to the light emitting units 111 and includes a plurality of lens units 1221 for covering onto the LEDs 1111 respectively, and the external surface of each lens unit 1221 has a microstructure 1222, such that each LED 1111 has an illumination range of a first angle α and a second angle β on a Y-axis and a X-axis of a surface of the lens hood 12 respectively. Wherein, the serrated structure 121 on the external surface of the lens hood 12 drives an external light such as automobile light or sunlight to produce multi-angle refraction and reflection effectively, so as to prevent affecting the light emitting effect of the LEDs 1111 and display the information clearly within the first angle α and the second angle β .

[0025] The microstructures 1222 come with a serrated surface or a wavy surface, and each microstructure 1222 has a cross-section in conical shape or circular arc shape corresponsive to the continuous bends and configured to be perpendicular to the serrated structure 121 on the external surface of the lens hood 12. Since the lens units 1221 has the microstructures 1222, so that the light emitting units 111 and the lens units 1221 have an excellent focusing effect to control the first angle α and the second angle β of the LEDs. Wherein, the external surface of each lens unit 1221 parallel to the X-axis has a baseline 1223, and the external surface of each lens unit 1221 is partitioned into two areas, and at least one area of the external surface of each lens unit 1221 is tilted towards a surface of the lens tray 122 or tilted towards a surface opposite to the lens tray 122, so that the external surface of each lens unit 1221 is tilted towards the lens tray 122 (viewing from the cross-

section with the baseline 1223 as a standard line) or tilted opposite to the lens tray 122, and the tilted area has a predetermined thickness d which is smaller than the total thickness D of the lens units. In this preferred embodiment, the microstructures 1222 are serrated surfaces, and an area of the external surface of each lens unit 1221 separated by the baseline 1223 is tilted from the baseline 1223 towards the lens tray 122, and an angle of inclination γ is included between the area and the baseline 1223, wherein the angle of inclination γ falls within a range of $70^{\circ}\sim 85^{\circ}$, so that each light emitting unit 111 has an illumination range of the first angle α and the second angle β to enhance the light directionality of the light emitting module 11 and assure a specific illuminating brightness in different environments. Since each lens unit 1221 is tilted, therefore when the light of each light emitting unit 111 is emitted from the lens units 1221, the illumination angle is limited effectively. In the meantime, the microstructures 1222 further limits the illumination range within the first angle α and the second angle β . In addition, the light emitting units 111 are arranged equidistantly with an interval apart with each other and formed into a matrix, and the interval is greater than or equal to 10 millimeters (mm) and smaller than or equal to 35 millimeters (mm). To cope with the position of installing the LED traffic billboard 1 and the distance for viewing the LED traffic billboard 1 by pedestrians, the interval may be adjusted to maintain the best light emitting performance, while taking the cost and manufacturing time into consideration to obtain the best efficiency by the minimum cost.

[0026] To provide the best light emitting effect of the LED traffic billboard 1 in different environments, the structural design of each lens unit 1221 and the microstructure 1222 keeps the illumination range of the first angle α of each LED 1111 to be 15° , so that the light of the LED traffic billboard 1 is focused at the lower-half area of the lens unit 1221, and the illumination range of the second angle β is 30° to collocate with the illumination range of the first angle α , so that the LED traffic billboard 1 can be reduced within a visible display range. Since each lens unit 1221 is tilted, the degree of concentration and the directionality of the light can be adjusted to a certain extent. In general, the convergence and divergence of the light depends on the thickness of a medium that the light passes. For example, a light projected on to a convex lens produces a converging effect, and a light projected onto a convex lens produces a diverging effect. For simplicity, if the light enters into a medium with

a non-uniform thickness, the light will be refracted and converged towards a thicker area of the medium. In a medium such as the convex lens having a thicker middle and a thinner edge, after the light has entered into the interior from a side parallel to the main axis of the convex lens, the light is refracted at an area with a thicker middle of the convex lens and finally focused at a point on the other side of the convex lens, so as to achieve the converging effect of the light. Therefore, the illumination range and angle of the light can be controlled by controlling the thickness of the medium that the light passes. In the present invention, a side of each lens unit 1221 corresponding to the LEDs 1111 is a spherical surface, so that after the light of the LEDs 1111 is projected to the lens units 1221, the tilted external surface of the lens units 1221 keeps the light within an illumination range of a first angle α , and an upper area of the lens units 1221 with respect to the baseline 1223 is tilted, so that the predetermined thickness d is smaller than the total thickness D of the lens units 122, and the light will move towards the lower area and produce an illumination range of the first angle α . Wherein, the predetermined thickness d falls within a range of 1.2mm~2.0mm, preferably equal to 1.6mm, and the total thickness D falls within a range of 2.4mm~3.0mm, preferably equal to 2.77mm, and silicone is adopted to enhance the UV resistance and prevent the light transmission capability of the outdoor LED traffic billboard 1 from being affected by sunlight. Therefore, the LED traffic billboard 1 has a specific broad illumination range to enhance the light directionality of the LED traffic billboard 1, not just achieving the focusing effect only, but also providing a sufficient brightness of the LED traffic billboard 1 and a complete guidance effect. In addition, the LEDs 1111 produce a specific light emitting range of the first angle α and the second angle β , so that only the pedestrians situated within the illumination range of the first angle α and the second angle β can see the displayed information, but the other pedestrians will not be disturbed by the information displayed on the LED traffic billboard 1. For example, when the LED traffic billboard 1 is installed on one side of two-way lanes, and the displayed information is intended for pedestrians on one-way only, the light emitting information of the LED traffic billboard 1 will not be seen by the pedestrians on the opposite lane, so as to prevent affecting the pedestrians facing the opposite direction. When the LED traffic billboard 1 is situated in the light emitting range of the first angle α and the second angle β , the microstructures 1222 of the lens units 1221 reduces the light emitting angle of the LEDs 1111 effectively, and the light is focused more easily, so

that the LED traffic billboard 1 provides a stronger light intensity for a specific viewing distance, or the LED traffic billboard 1 provides a stronger light emitting intensity for a farther projecting distance.

[0027] Further, at least one waterproof plastic strip 101 is installed at the periphery of the frame 10, and a hydrophobic nano plastic layer 112 is covered onto the circuit board of the light emitting module 11, and the frame 10 is coupled to the lens hood 12 by a post-installation method, so that there will be no locking hole on the surface of the lens hood 12 to enhance the waterproof effect. The waterproof plastic strip 101 fills the gaps between the frame 10 and the light emitting module 11 and the lens hood 12 to prevent moisture from entering into the LED traffic billboard 1. In this preferred embodiment, there are a plurality of waterproof plastic strips 101 installed at the external periphery of the frame 10 and the internal periphery of the frame 10 respectively, and the hydrophobic nano plastic layer 112 is covered onto the circuit board of the light emitting module 11 to further prevent the circuit board and the LEDs 1111 from being affected or damaged by moisture.

[0028] In FIGS. 6, 7 and 8 for an exploded view of another implementation mode, a cross-sectional view of a lens unit, and a cross-sectional view of a lens tray of a preferred embodiment of the present invention respectively, each light emitting unit 111 of this implementation mode is comprised of three LEDs 1111 arranged into a triangular shape, and the LEDs 1111 have the same color temperature or different color temperatures, and each lens unit 1221 is configured to be corresponsive to the light emitting unit 111 and has three lenses arranged into a triangular shape, and the external surface of each microstructure 1222 is a wavy surface, and an area separated by the baseline 1223 is tilted outwardly from the baseline 1223 opposite to a surface of the lens tray 122. In FIG. 8, each lens unit 1221 is preferably composed of three lenses and tilted from the baseline 1223 opposite to a surface of the lens tray 122 and has a different angle of inclination with respect to the baseline 1223 to collocate with a desired warning effect provided by the LEDs of different color temperatures. The LEDs 1111 are arranged into a triangular shape and matched with the control of the same color temperature or different color temperatures, so that the LED traffic billboard 1 has more diversified display information and modes. In each lens unit 1221 as shown in FIG. 6, the design principle of Fresnel lens can

reduce the overall structural thickness to facilitate the overall construction and installation. In the meantime, the incident surface of each lens unit 1221 may be designed in a way such that the incident light is scattered uniformly first to prevent the LED 1111 to have non-uniform light intensity due to the directionality, and then the microstructures 1222 designed on the light exit surface of each lens unit 1221 focuses the light before emitting the light, so that the light utility rate of each LED 1111 is improved to enhance the overall brightness performance. After the light exits, the uniformity of brightness is improved significantly to facilitate pedestrians to view and recognize the displayed traffic information.

[0029] In the LED traffic billboard 1 of the present invention, the light emitting angle of the light emitting units 111 of the light emitting module 11 may be limited by the microstructure 1222 on the external surface of each lens unit 1221 of the lens tray 122 effectively, and the design of the tilted external surface of the lens units 1222 is provided for adjusting the illumination range of the light, so that the LED traffic billboard 1 displays information clearly with a specific light emitting efficiency within a specific light emitting range. Since the light emitting range of the light emitting units 111 is limited, the light intensity of the light emitting units 111 is improved, and the LED traffic billboard 1 produces a longer visible distance. In other words, the LED traffic billboard 1 may have a specific visible distance without requiring a too high light emitting intensity of the light emitting units 111, so as to lower the power consumption of the LED traffic billboard 1 effectively. In the meantime, the heat generated by the light emitting module 11 can be reduced to extend the service life of the LEDs 1111. In addition, the present invention combines the lens hood 12 with the lens tray 122 to cover the light emitting module 11 therein, and uses the waterproof plastic strip 101 and the hydrophobic nano plastic layer 112 to improve the waterproof effect of the LED traffic billboard 1 significantly, and a post-installation method is adopted to connect the lens hood 12 and the frame 10 in order to skip the combining structure of the locking hole, so as to further improve the waterproof effect.

CLAIMS

1. An LED traffic billboard, comprising a frame, a light emitting module and a lens hood, and the frame being sheathed on the light emitting module, and the lens hood being covered onto the light emitting module, characterized in that the light emitting module comprises a plurality of light emitting units arranged into a matrix, each having at least one surface-mount device (SMD) LED, and an external surface of the lens hood has a serrated structure; a lens tray is coupled to a side of the lens hood, and the lens tray is integrally formed with the lens hood, and the lens tray has a plurality of lens units corresponsive to the light emitting units and covered onto the LEDs respectively, and the external surface of each lens unit has a microstructure, such that each LED has an illumination range of a first angle and a second angle on a Y-axis and an X-axis of a surface of the lens hood respectively, and each microstructure is a serrated surface or a wavy surface disposed perpendicular to the serrated structure.
2. The LED traffic billboard of claim 1, wherein the external surface of each lens unit parallel to the X-axis forms a baseline, and the external surface of each lens unit is divided into two areas, and at least one area of the external surface of each lens unit is tilted from the baseline towards a surface of the lens tray or tilted with respect to a surface of the lens tray and has a predetermined thickness, and each microstructure has a cross-section substantially in a continuously bending conical shape or circular arc shape.
3. The LED traffic billboard of claim 2, wherein each lens unit has a spherical surface corresponsive to the LEDs, and after lights of the LEDs are projected onto the lens units, the tilted external surface of the lens units keeps the light within an illumination range of the first angle illumination range.
4. The LED traffic billboard of claim 3, wherein the light emitting units are equidistantly arranged with an interval apart from one another and formed into a matrix, and the interval is greater than or equal to 10 millimeters and smaller than or equal to 35 millimeters.

5. The LED traffic billboard of claim 4, wherein the first angle is equal to 15° , and the second angle is equal to 30° .
6. The LED traffic billboard of claim 5, wherein the frame has at least one waterproof plastic strip installed around the periphery of the frame, and the circuit board of the light emitting module is covered by a hydrophobic nano plastic layer.
7. The LED traffic billboard of claim 6, wherein the frame is coupled to the lens hood through a post-installation method, so that the surface of the lens hood is free of locking holes to enhance water resistance.
8. The LED traffic billboard of claim 7, wherein each light emitting unit is formed by three LEDs arranged into a substantially triangular shape, and the LEDs have a same color temperature or different color temperatures, and each lens unit is configured to be corresponsive to the light emitting unit and has three lenses arranged into a substantially triangular shape.