CP1-06 Solar Cell Powered Solid-State Spotlight

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Introduction

Nowadays, the incandescent light is commonly used in decoration, especially for buildings. It is, however, that the temperature of operation is quite high, which is not safety enough if someone gets hurt by touching its case.

LEDs can now be fitted into decorative fittings for creative illumination without worrying about excessive heat causing potential fires.

With LEDs and solar panel to achieve reusable energy, our product is to combine these two characteristics. To make it much user-friendly, it also has a panel to change the colour manually or automatically. The discrete component and integrated-circuit solutions are incorporated in our design.

Design Specifications

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Solar cell</th>
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<tbody>
<tr>
<td>Battery</td>
<td>Lead-Acid Battery Charger</td>
</tr>
<tr>
<td>Controller</td>
<td>8051 Microcontroller</td>
</tr>
<tr>
<td>LED modules</td>
<td>16 × Luxeon Star (Lambertian)</td>
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<tr>
<td>Visible angle</td>
<td>135 degree maximum</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Maximum 36°C (at 25°C room temperature)</td>
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Function Modes

- Auto-changing colour
- 10 colours selection (including Warm white / cool White)
- Fixed colour
- The speed of colour change.
- Display the stage of speed on the seven-segment display
- Adjust the working hour by using timer relay

System Block Diagrams
**Implementation**

A Regulator was used for charging a battery.

Different homochromatic powered LEDs (Light Emitting Diodes) were used for colour maxing by pulse width modulation (PWM).

**Final Product**

Pattern of LEDs

Colour mixing

Pulse width modulation of three basic colours
It shows that the maximum power point of the solar panel usually at the range of 15 to 16 volts whatever the weather is. The efficiency of our regulator can reach at least 80% and usually 90% (refer to the above figures, the red arrows show the regulator input range (roughly equal to output voltage) or more and it was acceptable.

The colour mixing corresponding to CIE coordinates
From the obtained result, we can conclude that the mixed colour by using the pulse width modulation is suitable. And we can denominate with specific name from CIE coordinates.

The comparison with the traditional lighting
With the graph shown, the performance is similar to the traditional lighting. The luminance of traditional lighting is a little bit higher than the LEDs spotlight which due to testing error from others lighting.

Conclusion
We have achieved the following in our project:

- Our prototype is bright enough for basic decorating spotlight
- Our panel can have colour selection, holding colour function, displaying speed function and flexible operating time setting
- Reusable the solar energy