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The Implementation of Solar Charger for Christmas Light System

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ABSTRACT

In the recent years, the deficiency of energy and appearance of eco-awareness fasten the researches for renewable energy. Using solar cell to generate electricity and combining with LED which is characterized by saving energy to be an independent Illuminated System, which could not only support self-sufficient power and lower maintenance costs but also extend the time of night lighting.
Under the circumstances that Paris Agreement is limited and standardized, cooperate with the country to actively promote energy-conserving science and technology and energy industry in the future, this text proposes that Light Emitting Diode Lumileds and developed with the sun photo electricity, and apply the photoelectric system of the sun to the Christmas light, cooperate with green scientific and technological industry Light Emitting Diode Lumileds and develop with photoelectric industry of the sun, make both the renewable energy development and energy-saving policies of Taiwan can be developed continuously forever.

Keywords: Solar cell, LED, LED lamp driver, white light LED, inverter

INTRODUCTION

Global warming is getting worse, and climate abnormalities occur one after another around the world. After the Paris Agreement to curb global greenhouse gas emissions came into effect on November 4, 2016, energy technology innovation and changes in energy conservation social behaviour will become effective strategies for carbon dioxide reduction [1-2]. Every year during Christmas, every household needs to use Christmas lights. But some people decorate the Christmas tree outdoors, which is inconvenient because they can't find a socket. Some people use generators instead, which not only causes noise and carbon dioxide pollution, but also wastes petroleum energy. Therefore, this article actually reduces the waste of the earth's limited energy and makes it more convenient for users. Using solar energy, so the implementation of this article makes Christmas lights more environment friendly and energy-efficient.

Why use solar energy? It is because the biggest feature of solar energy is its immutability. It does not take away anything from the earth, nor does it bring any pollution. Solar energy itself is distributed and diffused in the form of energy, which is easy to obtain and has no pollution problems when used. It is also the most abundant and permanent energy source on earth. Therefore, how to research and develop the use of this kind of energy to save the consumption of current exhausted energy is an urgent issue.

Calculated based on the current energy consumption rate, consumable energy will be exhausted at the beginning of the next century.

The application of new energy (energy from nature) should have two basic principles: 1. As far as current demand is concerned; new energy should be inexhaustible and inexhaustible. 2. Expand

the distribution without being controlled by a monopoly.

As far as the current technological level is concerned, there are four types of future energy that meet the requirements and are practical, including nuclear energy, geothermal energy, solar energy and hydrogen. The only thing that complies with the above two principles is solar energy. Therefore, the application of solar energy has received increasing attention. However, solar energy research has certain difficulties. On the one hand, it is necessary to gather talents in meteorology, physics, chemistry, machinery, electrical machinery and even construction to work together. On the other hand, the early stage of any kind of technological development, as well as human concepts, usage habits and even technological standards will affect research and development. For example, all the energy of the earth comes from the sun and starts from the sun. It is called the mother of energy, and it is the most precious treasure given to mankind by nature. At present, the electricity consumed in the world only accounts for 0.0003% of the energy of the sun reaching the earth. It can be seen that the unlimited potential of solar energy can be used in a large range. Therefore, all countries in the world actively promote solar energy sources and widely install solar panels to obtain abundant energy.

Solar power generation is one of the best solutions with sufficient sunlight but insufficient power. If it can be used wisely, it can be used in school parks and other street lights to reduce the installation of nuclear power plants and thermal power plants, and also achieve the purpose of energy saving.

From the perspective of the characteristics of solar energy, its generation and application are mainly used in the conversion of heat and light into biology, chemistry, machinery, and electricity.

The implementation of this paper is mainly to use sunlight to make the solar panel produce a voltage difference, charge the battery and then convert the direct current (DC) into alternating current (AC) before providing it to the Christmas lights [3-9]. Making outdoor solar rechargeable LED lights Christmas lights can obtain the following advantages: 1. It can reduce the trouble of wiring. 2. Save energy use. 3. It also solves the problem that there is no power socket in the local area, so it can be more convenient to use.

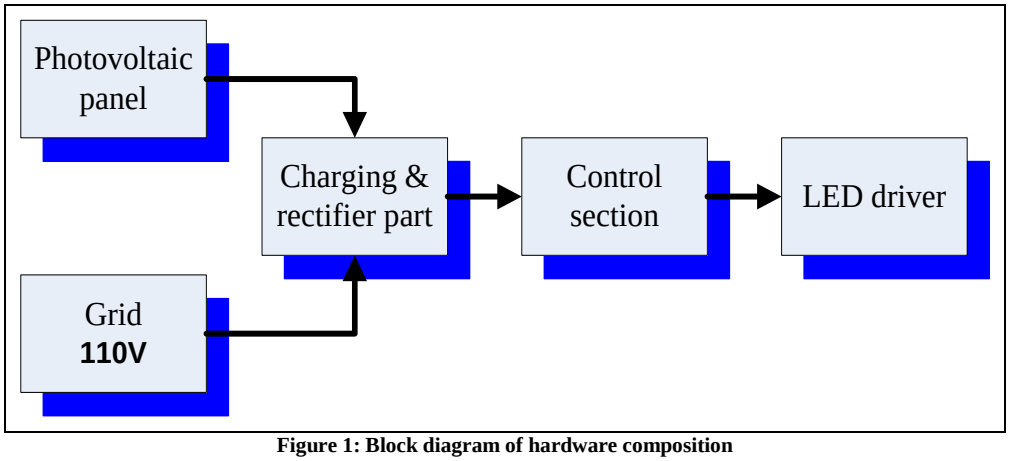

Figure 1: Block diagram of hardware composition

OPERATION PRINCIPLE OF HARDWARE CIRCUIT EQUIPMENT

This circuit is to fulfil solar LED rechargeable high-brightness Christmas lights. As shown in the block diagram of Figure 1, the main structure is divided into four parts: power supply, charging and rectification, control and LED driving. The operation principle of the simple architecture is shown in Figure 2 and Figure 3 as follows:

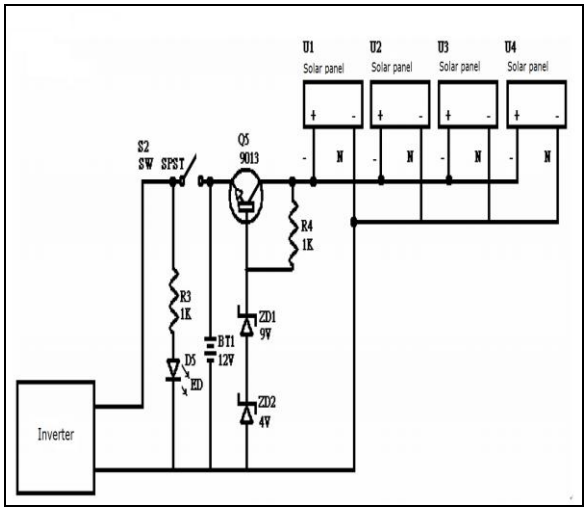

Figure 2: Solar charging circuit

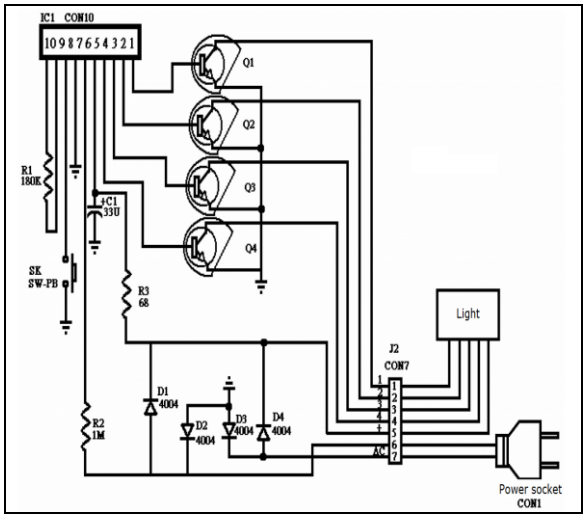

Figure 3: Solar charging circuit (Cont.)

First use solar panels as shown in Figure 4 to generate power and potential difference. After 9V Zener diode and 4V Zener diode, minus the base and emitter voltage drop of transistor 9013 is about 0.7V, about 12.3V left to charge the rechargeable battery as shown in Figure 5.

Then the battery and switch SW2 provide power to drive the light-emitting diode D5 to emit light, which represents providing power to the inverter. After converting direct current (DC) to alternating current (AC), drive the power socket in Figure 3. Through IC and button SW-PB and other control circuits, the blinking state of Christmas lights can be changed. In addition, a switch SW2 is installed between the power supply (battery) and the Christmas lights to control whether the Christmas lights emit light. To simplify the circuit, Figure 2 and Figure 3 do not include the circuit diagrams of the solar panels absorbing power to the battery, and the implement the overall circuit appearance is shown in Figure 6.

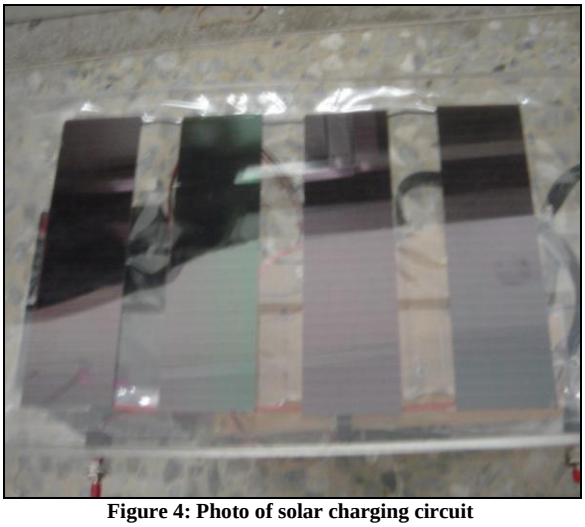

Figure 4: Photo of solar charging circuit

Figure 5: Photo of rechargeable battery

Figure 6: Photo of implement the overall circuit appearance

3. PRODUCTION PROCESS, FLOW TEST RESULTS AND DATA

The results implemented in this article are successfully tested and the functions are correct. The principle of operation is as follows: The switch on can charge the solar panel with a voltage of 20V and a current of 15mA. Charge the battery through the charging circuit. Then from the battery, and then into the inverter. The inverter converts DC 12V to AC 110V, and the current flows into the control circuit. The inverter voltage flows into the power socket.

Then the power socket voltage flows into the control switch, through the IC and the button. It can change the blinking state of the Christmas lights. Photo of implement internal overall circuit is shown in Figure 7.

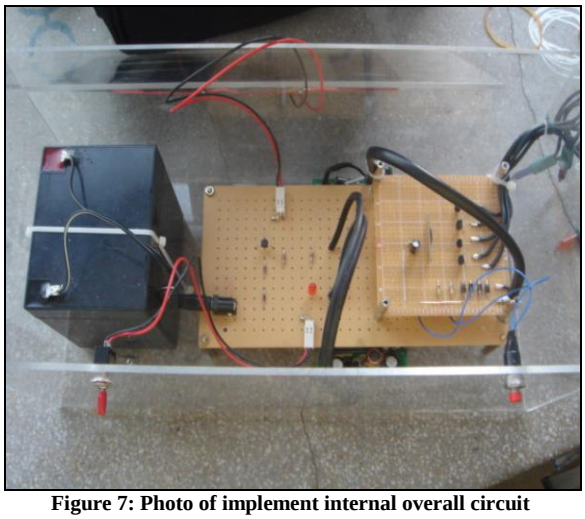

Figure 7: Photo of implement internal overall circuit

Figure 8: Inverter output voltage waveform

The experimental data is described as follows: The solar panel can be charged for about 60mAH for 1 hour, the voltage of the solar panel is about 20V, and the voltage of the solar panel is about 15mA. The output voltage of the inverter is AC 110V. The power consumption of the Christmas lights is depicted as follows: (1) The total power is 52.8W; (2) The power consumption of each light bulb is 0.42W. The output voltage of the controller is about 4V, and solar charging takes about 80 hours to fully charge.

The inverter output voltage waveform is shown in Figure 8, The output voltage is AC110V rms simulation sine wave. The battery output voltage waveform is shown in Figure 9. The output voltage is DC12V.

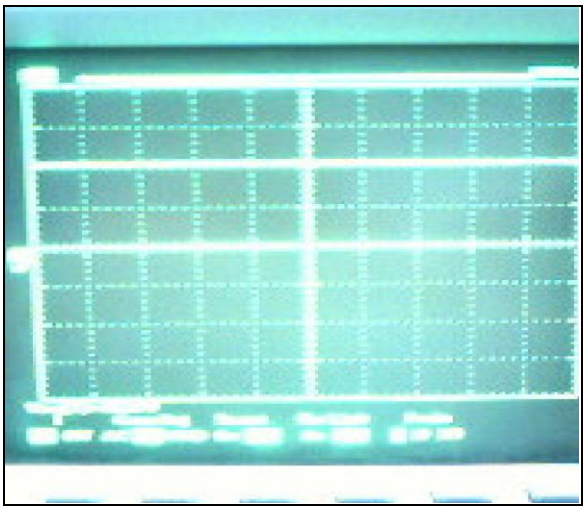

Figure 9: Battery output voltage waveform

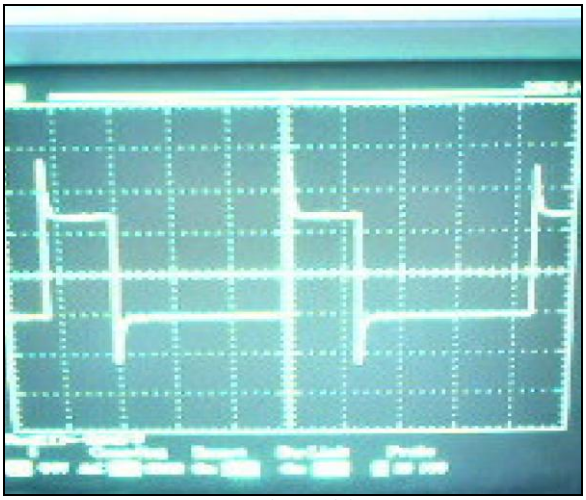

Figure 10: The output waveform of fixed direction transistor Q1

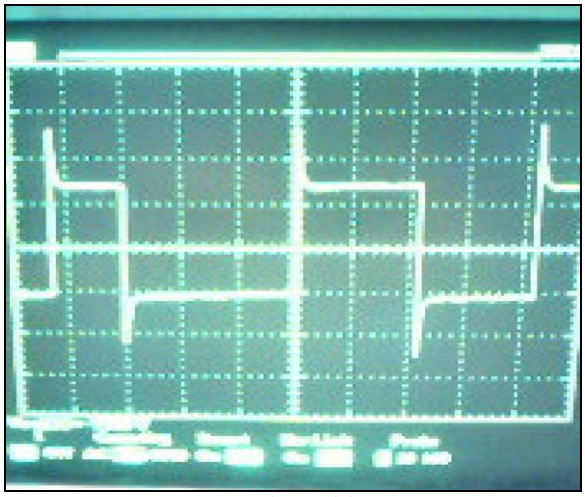

Figure 11: The output waveform of fixed direction transistor Q2

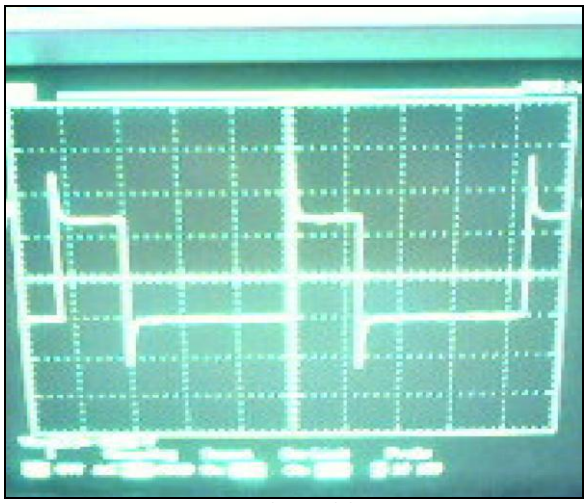

Figure 12: The output waveform of fixed direction transistor Q3

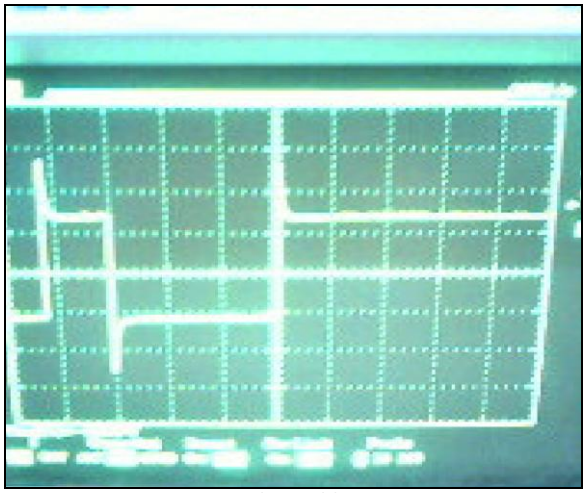

Figure 13: The output waveform of fixed direction transistor Q4

The output waveform of fixed direction transistor Q1 is shown in Figure 10. The output waveform of fixed direction transistor Q2 is shown in Figure 11. The output waveform of fixed direction transistor Q3 is shown in Figure 12. The output waveform of fixed direction transistor Q4 is shown in Figure 13

CONCLUSION AND FUTURE RESEARCH DEVELOPMENT

The advantages of this paper are described as follows: The power source is from solar energy, which can reduce the trouble of wiring. The use of energy saving can solve the trouble of socket power supply, so it can be more convenient to use. It can effectively use solar light to store electricity in the battery for Christmas lights. Its shortcomings are: solar energy has low continuous power and storage power is too slow.

Solar panels are expensive. The finished product is too bulky. The button switch is unstable.

Its future research and development goals are: because the continuous power of solar panels is low and the time for absorbing solar light is long, it must be able to be charged with grid to reduce the time for solar charging. In addition to using solar light to charge the battery, it can also be connected to the indoor power socket to charge the battery, so that the stable power in the battery can be kept from being insufficient for a certain period of time.

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