

THE INNOVATIVE PRODUCT DESIGN OF THE ENERGY-SAVING SUCTION LIGHT BALL

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ABSTRACT. *It is quite dangerous when being in a dark place and unable to find the light switch in a short time or when not being able to find the way at night in a camping trip. All current related solutions can only illuminate when being plugged or being powered by a battery/batteries. They are too big to be carried easily and are not eco-friendly at all. The energy-saving suction light ball developed by this study can be charged through the charging slot or the solar panel when not in use. When it is needed, users can simply throw it out at will and it will suck to something and glow on its own. If it is no longer needed, users can take it off and the power will be turned off automatically. This product can increase the safety of walking. It is small, eco-friendly, and easy to carry, and its market potential is very high.*

Keywords: Light ball, Innovative design, Product design

1. Introduction. Kids love to play with a toy called the “suction ball”. The surface of the ball is full of sucking discs. It can suck to anything, such as a piece of glass, a desk, a chair, a fridge, a closet. It is unusual and fun. What if this ball can illuminate? How nice would that be? It can then become a portable light in our daily life. Difficult situations such as not being able to find the light switch or plugged in a dark place and not being able to find the way at night in a camping trip can all be resolved. All current related solutions can only illuminate when being plugged or powered by a battery/batteries. And they are too big to be carried easily.

When not being able to find the way in a dark place, users can throw the light ball toward a floor, a wall, a ceiling, etc. at will and the place would be lighted up and all possible dangerous situations can be avoided. The suction of the sucking discs on the light ball is very strong. When the ball touches a surface, it can suck to it right away and start to glow. When the ball is removed from the surface and is not in contact with any other surface, it is turned off. The rechargeable battery inside energy-saving suction light ball can be charged, or the ball can be charged through the solar panel without any battery. Either way, the ball can be charged in advance and keep on glowing when in use. It is small and easy to carry.

The suction light ball developed by this study can be charged with a lithium battery, through a USB port, or through its solar panel. To use it, users can throw it out at will and it will suck to something. Its LED light bulb then becomes a light source. This design is energy saving. When the light ball is no longer needed, users can take it off and shake it one more time to turn the power off automatically.

2. Literature Review. When creating through computer graphic design, it is important to take possible influences or interferences caused during interactions into consideration. The procedure after human brains sense and comprehend colors is a mental and physical phenomenon that so far we do not know clearly. Yet, through experiment results

and theories, physical properties of colors can be expressed. Full-color image processing is usually applied to TV cameras, color scanners, or other full-color detecting devices. Pseudo-color image processing is specific color intensity or appointing a color within a range of intensity. Most digital color image processing is performed on pseudo-color layers [7,9].

In the aspect of functions of colors, eyes rarely receive stimulation from one single color. Colors are usually combined or presented in different time orders. These colors may be surrounded by other colors or may become background colors. They can scatter or be distant from each other. Also they can get close or neighbor each other. When conditions of their relative relations change, their visual presentations also change. Originally different colors may lead to similar visual effects this way. Visibility of a color is the degree of cognizing and distinguishing that color. Generally, it depends on the brightness difference between figure and ground. Color inducibility is the degree of multiple colors within certain field of view catching audience's eyes. Usually, high color saturation and high brightness lead to high inducibility. Color intelligibility is the characteristic of delivering a message in an easy-to-understand way when arranging or combining multiple colors [3].

According to a study about light balls, the author believed that the outline characteristics of a spheroid target are not influenced by the location of the target and proposed a rapid calibration method for the structured light system of a single spheroid target [10]. Another study applied some new materials and techniques to the design and manufacturing of new-technology light balls, in hope of achieving the goal of saving more energy [4]. Also there is a study discussing the structural issues regarding the relationships of electric charge, energy, and ripple frequency of a light ball with ball lightening and earthquake lights model based on the applications of the theoretical models [5].

3. Innovative Product Design. Regarding the R&D ideal of product design, a lot of related studies believe that the key factor behind success is innovation. Common understanding among different levels must be reached in personnel assignment, policy implementation, and design management, in order to support the design procedure and achieve a satisfactory result [6]. According to the data from many studies, innovation is the intervening variable for product development. Through continuous discussions and reviews, constant modifications of design procedure, and maintaining uniqueness of product features, innovation in both theory and practice can be helpful to product development as a positive protection, and customers' potential demands and expectations are more likely to be predicted correctly [1,2]. Although the procedure of integrating innovative management into product development is rather strict, the strict requirements on data and repeated confirmation of system information can always shorten the distance between the actual design result and the expected goal [8].

Will good computer graphic skills, the creative idea can be presented more thoroughly. User scenarios can be simulated through graphs and the internal machinery, required materials, and arrangement of the materials can be displayed through the structure graphs. Secondly, in the process of innovative product design and R&D, it is important to perform color planning in order to provide potential consumers a large variety of choices to stimulate their consumption. In this study, the teachers who guided the students were from different schools. The cross-school collaboration was performed through face-to-face discussions, facebook, and emails, with the purpose of helping the student to evaluate and confirm his creative ideas, to apply creative thinking, to review existing information of related patents and products, and eventually to propose the innovative product design of the energy-saving suction light ball.

In the aspect of the internal structure, the ball is a transparent hollow sphere. On the outside, several sucking discs are closely spread over the surface. On the side, there is a solar panel and a charging port. Inside the ball, there is a battery, a vibration switch,

and a light source, connected to the solar panel. The design is convenient for users in a dark place where they can barely see clearly. They can throw the ball toward a floor, a wall, or a ceiling and the ball would be attached to it. The ball can be easily fixed and can then light up the dark place. There is no need to spend time looking for a switch or a plug. Users can also do other things with both of their hands.

4. Design Results. The creative idea for the innovative product design of the energy-saving suction light ball is that when being in a dark place, one can throw the suction energy-saving light ball toward a floor, a wall, or a ceiling to which the light ball can be attached and fixed.

The light ball can illuminate and increase the convenience and safety when going out at night. When the energy-saving light ball is fully charged, it should last for up to 8 to 12 hours. The user scenarios (Figure 1), internal structure (Figure 2), and color planning (Figure 3) are illustrated through the graphs. The Taiwan utility model patent application for the design was submitted and approved (Figure 4).

This work also participated in the 2014 KSBDA Paris International Invitational Exhibition in Centre Culturel Coréen, Paris, France. There were a total of 15 participating countries in this exhibition (Figure 5). It participated in the 2015 New Media Art Creative Design Travelling Exhibit and is exhibited in 12 high schools of the strategic alliance (Figure 6).

The creator was interviewed by the reporter of the college journal and there is a picture when posed for a photo (Figure 7). This work also participated in the 2014 Technology Commodification Creativity Competition held by the Far East University. In the national

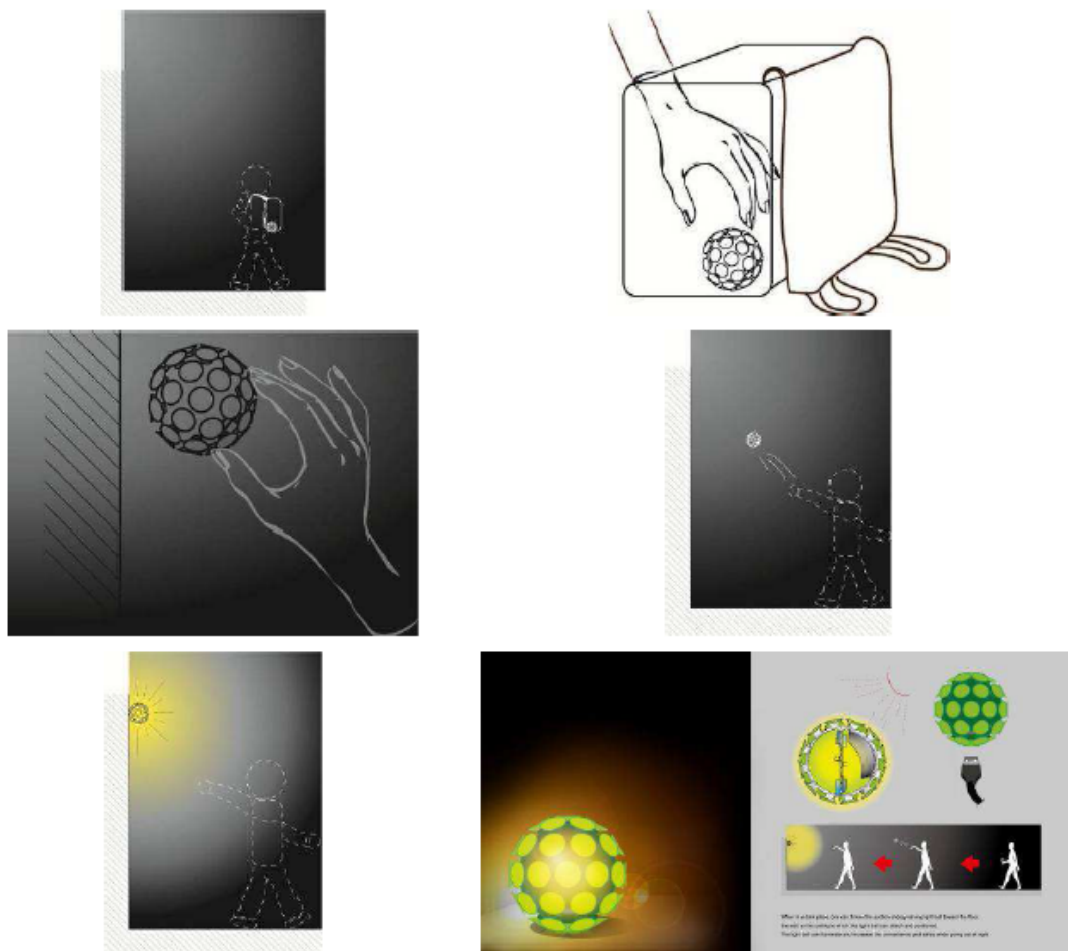


FIGURE 1. User scenarios for the energy-saving light ball

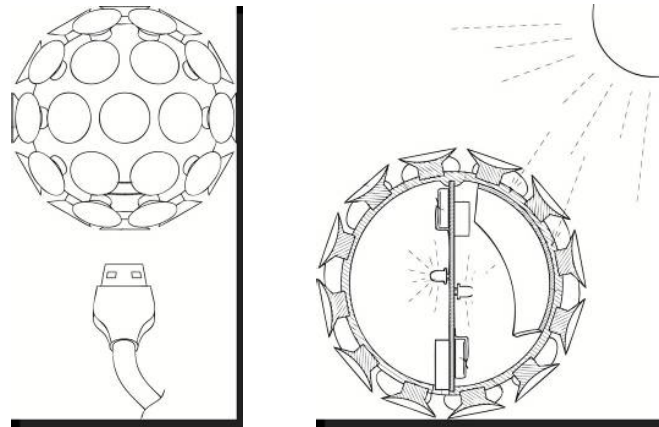


FIGURE 2. Internal structure of the energy saving light ball

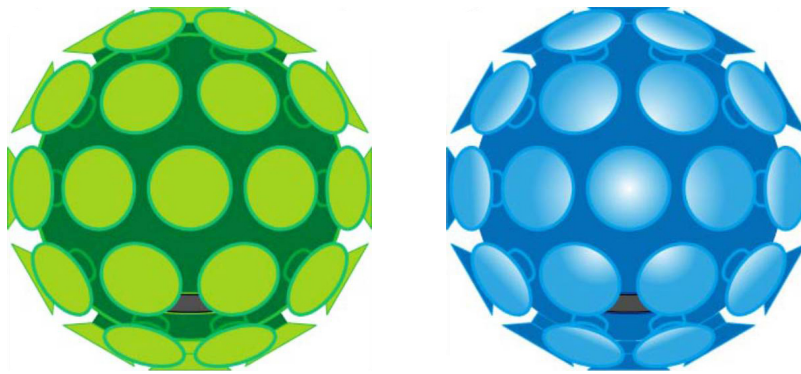


FIGURE 3. Color planning of the energy-saving light ball

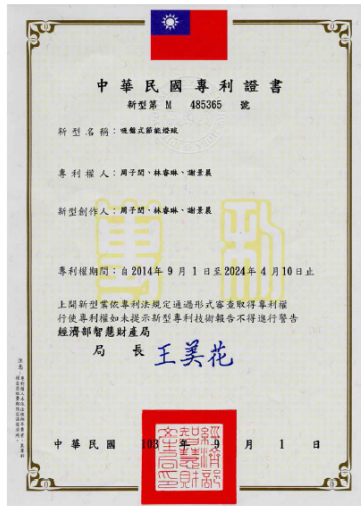


FIGURE 4. Patent application

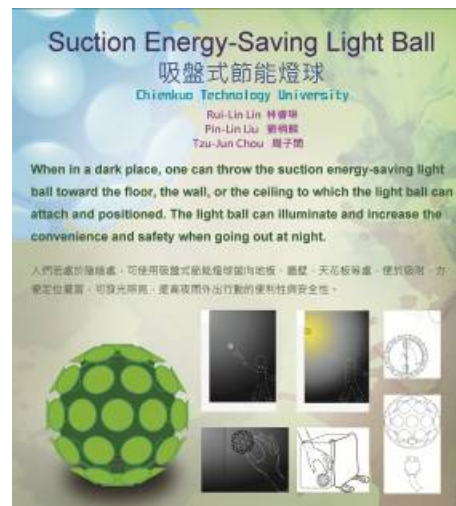


FIGURE 5. Exhibition participation in 2014

preliminary contest, 15 works passed, and in the semi-finals, this work won the honorable mention award (Figure 8).

In the 2014 International Young Inventors Award (IYIA) in Indonesia, this work was selected in the preliminary contest (Figure 9) and won the gold medal (Figure 10) and the Romania Special Award in the semi-finals (Figure 11). There were a total of 10 participating countries.



FIGURE 6. Exhibition participation in 2015



FIGURE 7. Interview by a journal



FIGURE 8. Honorable mention award



FIGURE 9. Selection in the preliminary contest in IYIA

5. Conclusions. The light source and the battery used for the energy-saving light ball developed by this study can be an LED bulb and a lithium battery respectively. When the ball is connected to a power source through its USB port, the illumination effect lasts longer. To turn it off, users only need to take the ball to which it is attached and shake it one more time. In sum, the features of the design from the innovative R&D of this study are illustrated below:

(1) It is dangerous to walk in a dark place. The suction of this slight ball is very strong. Users can throw it out anywhere and it will glow right there. To turn off the power, users only need to remove the ball from the thing it is attached to and shake it one more time. The current issue of walking in a dark place can be resolved.



FIGURE 10. Gold medal in IYIA

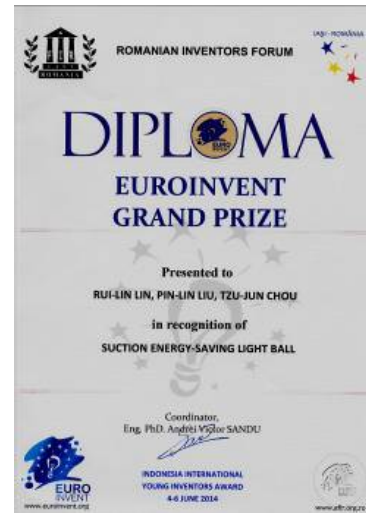


FIGURE 11. Romania special award in IYIA

(2) The ball can be charged through the charging slot or the solar panel when not in use. It is small, eco-friendly, and easy to carry, and there is no need to plug it when using it.

(3) This innovative product is like a toy while it also offers daily care functions. It can meet consumers' requirements for novel and fun products and increase potential customers' desire to purchase this product. Its market potential is very high.

(4) The utility model patent application for the final design from the R&D of this study was approved, and the design had participated in various international and domestic exhibitions and competitions and won many awards. All these facts show the general public's recognition of this product. It is worthy of related manufacturers' attention. It is hoped that in the future there can be an opportunity for the development and mass production of this design.

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