A Brand New Approach to LEDs Electronic Drawing Board Using Optical Illumination

Jiann-Hwa Lue[1], Yu-Sheng Su[2], Rong Seng Chang[1], Shuan-Yu Huang[3,4], Tai-Chuan Ko[5], Ting-Jou Ding[6*]

[1] Department of Optics and Photonics, National Central University, Chung-Li, Taiwan, R.O.C.
[2] Research Center for Advanced Science and Technology, National Central University, Taiwan, R.O.C.
[3] Department of Ophthalmology, Chung Shan Medical University Hospital, Taichung 402, Taiwan, R.O.C.
[4] School of Optometry, Chung Shan Medical University, Taichung 402, Taiwan, R.O.C.
[5] Department of Optometry, Jen-Teh Junior College of Medicine, Nursing and Management, Miaoli, Taiwan, R.O.C.
[6] Department of Electro-Optical and Energy Engineering, Ming Dao University, Chang-Hua, Taiwan, R.O.C.
tjding@mdu.edu.tw

Abstract: This paper presents a brand new method to Light-Emitting Diodes (LEDs) drawing board which can be induced by optical illumination. White light is used as an induced medium on this LEDs drawing board for accurate painting. Experimental results show that the white light source can successfully light up the 3×3 array LEDs drawing board. This brand new optical induced lighting technique will not only improve the disadvantage of traditional LEDs display lighted up by water, but also enhance the accuracy and feasibility of remote painting. Besides, the large outdoor interactive LEDs electronic drawing board, lighted up white light, will be expected in near future. [Jiann-Hwa Lue, Yu-Sheng Su, Rong Seng Chang, Shuan-Yu Huang, Tai-Chuan Ko, Ting-Jou Ding. **A Brand New Approach to LEDs Electronic Drawing Board using Optical Illumination.** *Life Sci J.* 2014;11(6):350-352] (ISSN:1097-8135). http://www.lifesciencesite.com. 48

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1. Introduction

Recently, the advancing technology has allowed Light-Emitting diodes (commonly called LEDs) to become the dominant and near-future light sources for many economically and technologically important applications. For example, the light sources in traffic signals, information and image displays, full-color illumination for back-lighting liquid crystal displays, automotive headlight and taillights, etc. [1] Due to the promotion of LEDs conversion efficiency, LEDs have become a new green energy light source in lamps, cell phones, and remote control displays, etc.[2] Furthermore, LEDs have various advantage features, such as high color saturation, rapidly start, no mercury pollution and long life, LEDs have been widely used in outdoor landscaping, electronic billboards and outdoor art drawing display. [3]

The large displays of 10-ft interface are well suited [4] because their high resolution enables the LEDs display can clearly show large amounts of information. However, most researchers in this field of large displays mainly pay attention to rapidly transfer and display huge amounts of data, only few of them study the function of interaction. [5]

In the last two decades, LEDs panel display is mainly used in the large dynamic advertisement billboards. According to new techniques, LEDs have been applied to outdoor electronic drawing board so that it provides people a new visual experience in recent years. Among them, the LEDs display lighted up by water flow is the most attractive techniques. [6] However, this method will be affected by many circumstance factors such as wind, obstacles of building, gravity, distance and display panel size etc., the painting cannot be precisely shown. [7] As a result, the LEDs display panel cannot be widely used in an interactive outdoor application. [8]

In present study, we propose the concept of the LEDs array lighted by optical light to improve the mentioned disadvantages of large interactive outdoor LEDs display. By using optical light, we can improve the accuracy and long distance drawing on the LEDs display which is workable. In addition, we can also use optical light to improve another disadvantage that the LEDs lighting will extinguish without the water flow continuously applying to it. Optical light induced technique is helpful to make the large outdoor LEDs display drawing board more practically used.

2. Principle of Light Emitting Diodes:

LEDs are made from multiple layers of semi-conductors with two doped zones: positive (or P-type) and negative (or N-type). When the diode is applied forward voltage, electrons are injected into the N-type area and holes are injected into the P-type area. Both holes and electrons are annihilated at the junction. Light can be emitted from a semiconductor material as a result of electron-hole recombination. In general, LEDs materials cannot emit light at room temperature because the concentration of thermally excited electrons and holes are too low to produce discernible radiation. Nevertheless, an external source of energy can be used to excite electron-hole

pairs in sufficient numbers, and then they produce large amounts of spontaneous recombination radiation and cause the material to glow or luminescence. A convenient way of achieving this is to forward bias a P-N junction, which has the effect on injecting electrons and holes into the same region of space; the resulting recombination radiation is then called injection electroluminescence. [9] [10]

Semiconductor photon sources, in the form of both LEDs and injection laser, are convenient because they are readily modulated by controlling the injected current. Their small size, high efficiency, high reliability and compatibility with electronic systems are important factors in their successful use in many applications. [11]

3. Electric circuit design and Setup

Experimental design concept is shown as Figure 1. The components are included: blue LEDs, light-sensitive resistors (or photoresistors, CDS), the control circuit and power supply. Power supply provides current and voltage to LEDs, CDS and relays. CDS and relay are connected in series. CDS is triggered by white light illumination. Then, LEDs are lighted up. The relay is used as an ON / OFF switch for a particular trigger controller.

Sketchpad structure side view LEDs display is shown as figure 2 (a). The photosensitive resistor and LEDs are on the front side and relay switch is on the back side. Figure 2 (b) shows the LEDs lighted up by white light illumination.

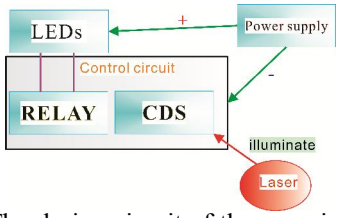


Figure 1. The design circuit of the experiment. There are four main components including: LEDs, light-sensitive resistors, control circuit and power supply.

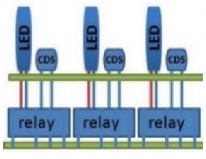
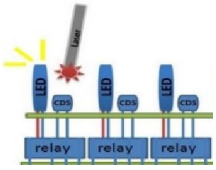


Figure 2 (a) Array LEDs drawing board side view.



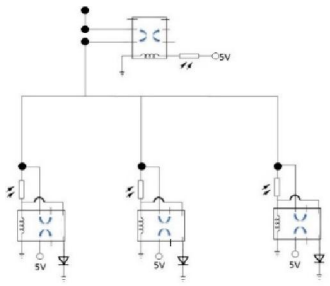
(b) Array LEDs lighted up by optical light.

The mainly used types and characteristics of electronic components in this experimental are shown in table 1, which includes relay (RY5W-K, LEG-5), blue LEDs, light-sensitive resistors and power supply.

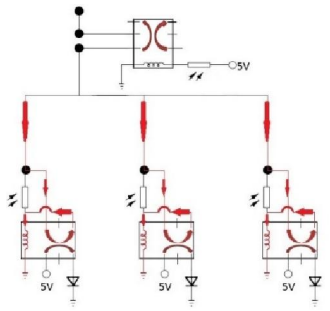
Table 1 Experiment part list.

Specification / Material Name	Model	Voltage	Electric current	Drive voltage
Blue LEDs		5V	10mA	3.3V
Relays	RY5W-K	120VAC 24VDC	0.5A 1A	
Relays	LEG-5	240VAC 24VDC	10A	
Photoresistor	CDS-05 (5mm)			

The experimental circuit schematic diagram of LEDs array illuminated by white light is shown as figure 3.



(a) Before.



(b) After.

Figure 3 The experimental circuit schematic diagram of the LEDs array is illuminated before and after the white light. (a) Before, (b) After.

4. Results and Discussion

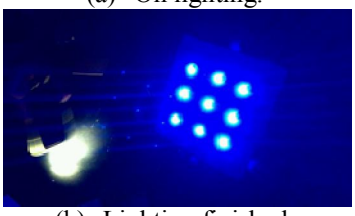
Figure 4 shows the simple 3×3 LEDs electronic circuit board, which is composed of 9 relays, 9 LEDs, 9 photoresistor (CDS). Each lighting set is composed of one LED, one relay and one CDS. When CDS is illuminated by white light, it will trigger the LEDs lighted.

Figure 4. The simple 3×3 LEDs electronic drawing board.

Figure 5 shows the experimental process of the white light induced LEDs array. In this experiment, the white light was used as an induced light source.

Figure 5(a) shows that 3 × 3 LEDs electronic drawing board is lighted when the white light is applied to it. All 9 LEDs are completely lighted in figure 5 (b). Finally, referring to figure 5 (b), we remove white light source and all LEDs still keep lighting.

(a) On lighting.



(b) Lighting finished.

Figure 5. The testing process of the white light induced LEDs array.

5. Conclusion

In this study, we use several common optoelectronic components to successfully design the optical illumination induced 3 × 3 array LEDs electronic drawing board. Experimental results show that the lighted LEDs array by white light, is still keeping lighting even though the white light is removed away from it. Comparing to traditional lighting method, this new LEDs lighted by optical illumination can successfully improve the disadvantage.

Moreover, with LEDs lighted by optical illumination, the large outdoor interactive electronic drawing display is not impossible anymore. Our continuous research has used this concept on 10 × 10 LEDs or 100 × 100 LEDs electronic digital drawing board design. We believe that the large outdoor interactive LEDs electronic drawing board lighted up by optical illumination will be expected in near future.

Corresponding Authors:
Ting-Jou Ding
Department of Electro-Optical and Energy Engineering, Mingdao University, Changhua, Taiwan, R.O.C.
E-mail：tjding@mdu.edu.tw

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