

Manufacture of LED Display Works based on Real time Interaction

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Abstract

Recently, diversified works utilizing LED characteristics including media facade have been manufactured. Owing to development of high-tech technology, such works have been miniaturized, slimmed and it has long service life of high efficiency and low energy with very fast response speed. This advantage could not only substitute existing electric bulb type light source but also provides a value of new industrial creation. Light divergence technology of LED significantly affects manufacture of light art works and arouses inspiration of many light artists. Under this background, as expression domain of LED is extended, interdisciplinary type culture has been cultivated. In this study, by using touch screen, interaction based effective and emotional LED controlled display works were manufactured and flexibility of LED interaction is intended to be considered through art work manufacture.

Keyword: Real time, Interaction, Interactive art, LED installation, Display works

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1. Introduction

LED as one of key technologies of high-tech IT industry has been extended to diversified areas. Typically, it provides innovative change to lighting and display system. So far, LED has been used in simple lighting device based on limited form and function but as diversified colors and high luminance LED have been developed and highlighted as eco-friendly and efficient substitute light source, its utilization becomes diversified methodologically [1].

In particular, as LED could apply diversified colors, spatial performance based on color is enabled contrary to existing light source and owing to development of this technology, LED lighting system that responses in real time by sensing signal input measuring various environmental changes and human senses has been developed in reality. Development of lighting technology not only plays a role of light that simply shines a space but also visually affects human emotion and lighting has been utilized in diversified fields functionally or aesthetically.

In particular, contemporary people show unusual concern over mental health as well as physical activity and try to have psychological, mental relaxation through diversified art fields such as fine art, music. Therefore, LED as lighting source could be utilized in display works efficiently. Contrary to existing light source, full color LED could control color, color temperature and brightness. As light controllable attribute change significantly affects human emotion, a study on a correlation between light and human emotion draws public attention along with development of LED[2]. Development of this LED technology enables communication with audience based on real time interaction achieved in media display.

It is true that LED being started as lighting device for containing light has been highlighted as a new material of fine art at present because interactive physical expression of vitalizing light by controlling LED through computer is enabled[3]. Display works utilizing LED have been applied as diversified media and displayed in showroom in diversified ways as well.

This shows interesting artistic divergence in which technical convergence becomes art work effectively. Like this, depending on features of media utilizing LED, manufacturing method, expression, choice of grafted material becomes diversified. The reason why LED draws attention as a new material of display is that it could be controlled electronically as electronic parts, not electricity because tiny LED elements could extend space by forming diversified light volume through electronic control. Also, it has already implemented possibility of interaction by light being interfaced with human behavior or environmental change under combination with sensor[3]. Full color implementation and fast response speed as media features of LED are elements enough to instantly deliver feedback to the audience. In this study, by using LED, real time interaction display works are manufactured. Based on analysis of flexibility as media features of LED, extension of communication sensibility with the audience is pursued.

2. Flexibility of LED interaction

Fast response speed of LED enables real time interaction and as it could be combined with diversified sensors, there is almost no restriction in making smooth interactive relation with the audience. Response speed of media plays a very important role in interaction with the audience. Response speed of visual sense among human senses is exceptionally fast and it senses delay of one hundredth of a second. At present, in case of LCD display that is recognized as excellent display, as human eye senses its delay, when watching video of an object being moved at high speed, people sometimes feel dizziness by its after-image.

In case of LED, as its delay time is not more than just 1/hundred million second, it is considered to be an ideal light source for interaction because in interaction between art work and the audience, perfect simultaneity could be implemented. Flexibility of LED interaction is derived from the fact that light brightness and color could be controlled freely[4]. Brightness control of LED is achieved by minutely changing ratio of time when LED turns on. In particular, in case of controlling brightness by ratio of time when LED turns on,

as brightness of 1024 level or its over could be controlled, very delicate and flexible response is enabled. As more diversified color could be expressed when using full color LED having high color purity and adding brightness control of 1024 level, flexibility of color expression is infinite as well.

As all the optical features of LED could be controlled by current only, expression from physical data being sensed at diversified sensors to abstract data being existed in a form of pure information in network is enabled. As all those have same digital data form, its function works just by converting it to current form. Through expression ability like this, LED works could communicate with the audience. Owing to fast response speed and flexibility, LED could be considered as one organism[4].

Interaction of LED by responding to sensor is a change depending on external environmental factor and it is considered to be a partial features of organism. In LED, there is no process of evolution, reproduction, growth being represented in organism but it is mutually combined by parts organically. Turning on/off process of light could be considered as a flowing process of birth and death of life and it achieves feedback at fast speed flexibly under communication with the audience. In addition, control principle of this organism is based on information having message. As Moholy Nagy considered it as general organism having all the possibilities of being able to combine and change diversified complexities such as light, space, plane, form, movement, sound, people, LED work could be also considered to be an organism being composed of multi-media elements[4]. By control of computer, it could sense and respond to environmental change or diversified inputs just like any other organism. In display works also, such works are manufactured by reflecting media features of LED.

3. Oido Variety display works planning

3.1. Background of the works

This work was planned in a process of directly changing color of display environment to diversified colors by the audience. Human being feels pleasure while emotionally accepting feedback for an environment being controlled by one's own behavior. In expression instinct of human being, in addition to lineal writing, radiant and multi-dimensional technique corresponding to original graphic image is originated at the same time[5]. Constructing display environment where expression instinct like this is radiated is like providing delight by an artistic behavior. Like this, display work is manufactured by looking human instinct squarely and applying it.

3.2. Concept of the works

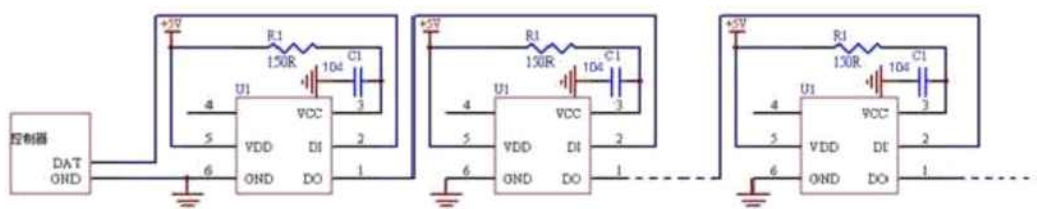
Artificial space is created by substituting natural environment of Oido by natural color light. In this space, an image of mud flat in ebb tide glitters as it is reflected by sunlight and an image of Oido lighthouse light shines on night sea wave are expressed abstractively. Display space of the works is installed in observatory inside and linkage with concept of other works is made. Inside of warship observatory, traffic line of the audience being made by comparing waterway based on Oido sea wave is designated. Traffic line is also reflected in this display works and through movement of this traffic line, light space is enjoyed. LED being used in the works is expressed in white hair inside without directly exposing light and the audience could directly select this light color and position and express it.

4. Implementation of Oido Variety display works

4.1 Hardware composition

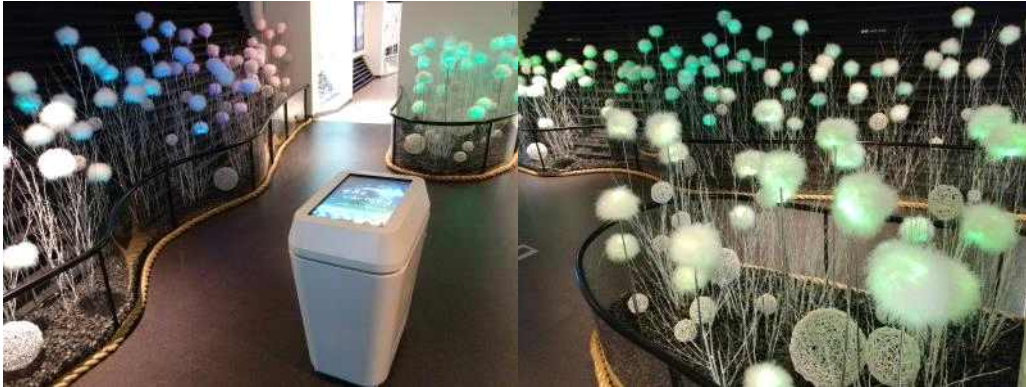
This display works is interactive media art using full color LED. LED uses 200 neopixels in which control circuit and RGB chip are integrated in order to control full color conveniently. Selling and using method of Neopixels is exucated by a company called Adafruit and among 80 types, "Adafruit NeoPixel Digital RGB LED Strip – White 60 LED – WHITE" is used. And this product is connected with extension cable by cutting it as one LED element. Fig. 1 shows neopixels connection circuit diagram and from this, element connection of each LED and data transmission path could be realized.

Each 1 LED element being connected like this is installed in inside of 60mm ball covered with white hair and each ball fixed to stainless steel bar of 1000mm, 750mm, 500mm. This stainless bar is welded and erected to the floor of showroom. Based on neopixels specification, SMPS power supply system uses power over 5V, 20A. In the center of showroom, kiosk type touch screen and computer, arduino are installed. Display works are divided into 3 zones and all the connection cables are buried by progressing showroom floor works for inter-zone cable connection. After processing PC and installing program called Arduino in it, touch screen and LED are interfaced through serial communication.



[Fig. 1] neopixels connection circuit diagram

4.2 Implementation of the works



[Fig. 2] still image of contents

Warship observatory showroom is located at Oido, Siheung City, Gyunggi-do and relevant contents are manufactured and displayed in and out of the showroom. Display contents are composed of 20 contents by planning topic relevant to beautiful natural landscape of Oido. This work is displayed in warship observatory permanently. The audience could freely control expressed light in a space as if drawing a painting by directly selecting desired color. Light being formed like this expresses meeting between the audience and Oido with diversified colors while dyeing the whole space as if revitalizing numerous living things. The works are divided into general mode and control mode. First, in case that the audience do not operate touch screen in general mode, diversified colors are animated repeatedly just like wave.

And in control mode, when touching ball image covered with hair after operating touch screen by the audience, real ball LED in relevant position turns on. At the same time, color coordination and dimming of each LED are enabled. The audience progress interaction with LED display works smoothly by using these functions. Utilization of LED media features in manufacturing process of this work enabled interaction with the audience, extension of display space and emotional approach and in interactive display, essential role for understanding media has been emerged.

5. Conclusion

In interactive display work that processes LED input data in real time, there is a restriction that only limited number of person could participate in system control but in actual display space where change of LED light could be sensed, more audiences could feel interest and participate in this space. Through contents based on participation of the audience, experience extension of two-way communication is achieved and bond of sympathy is formed. Flexibility of display space being extended and instant feedback being progressed owing to media features of LED is added to display works. In this process, feedback for color coordination of LED or LED brightness control at a specific position is transmitted through relationship formation by touch function[6].

The audience experience this process unilaterally based on procedure pre-determined by the artist. However, if this process persists, creative image of the audience is created in a space. Keeping in mind that LED might be manufactured with monotonous concept in a display space having specific concept called warship observatory of Oido, interaction being expressed in display space was considered by extensively utilizing media features of LED because in display work manufacture, objective of understanding and linkage of media features of materials is to provide a new approach method for communication method between the works and the audience.

References

- [1] Lee, Kyeong Jae, et al. "A study on the application methods through the analysis of LED light therapy products category.", *Journal of digital design* 12.4 (2012): 415-427.
- [2] Yun, Su-Jeong, and Lin, Chi-Ho. "Design and Implementation of Optimal LED Emotional-Lighting Control System." *The Journal of Korean Institute of Communications and Information Sciences* 40.8 (2015): 1637-1642.
- [3] Kim, Yeon Hwa. "A Study on Synesthesia LED System through Physical Interface." MS Thesis, Kookmin University of Department of Techno Design Graduate school (2008)
- [4] Lee, JeeHee. "A Study on LED-based Media Art." Ph. D. Thesis, Soongsil University of Department of Media Graduate school (2009)
- [5] Kim, S. D. "Homo mobilicus." Samsung Economic Research Institute, Seoul (2008).
- [6] Mok, Seonah, and Paik. Joonki. "Interactive Media Art Approaching Communication through the Nonverbal Communication." *The Journal of the Korea Contents Association* 13.12 (2013): 585-594.

