

Ambient Lighting for Korean Karaoke based on Screen Colors and Singer Interaction

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Abstract

Objectives: In this paper, an interactive ambient lighting system for Korean Karaoke using the Neo-Pixel strip is proposed to reflect the singer's action. This increases the immersion in the Korean Karaoke. **Methods/Statistical Analysis:** The singer's action is reflected in the lighting and the screen which give accents in the room and also controls the ambient lighting in front of the screen. We acquired the singer's action by the Kinect device, which is then processed by the processing software. The output controls the ambient light in the Korean Karaoke. Additional lighting controls can be also incorporated into the system, for example, a lighting control which controls the lighting according to the screen colors of the music video played in the front screen. **Findings:** Conventional Korean Karaoke has only simple lighting which does not match the mood in the Korean Karaoke. The contribution of this work is that it introduces the usage of interactive ambient lighting, and thus is a first attempt to introduce interactivity in the Korean Karaoke. This provides the singer with more immersion, and will result in a greater satisfaction, which again will elevate the sales of musical instruments for Korean Karaoke. **Application/Improvements:** The proposed technique can be directly applied to construct an interactive musical instrument for Korean Karaoke which gives the singer an increasing immersion.

Keywords: Ambient Lighting, Interactive, Karaoke, Neo-Pixel

1. Introduction

A Korean karaoke, which is also called Norebang in Korea, is a place where everyone enjoys singing together and having fun by interactively playing together with other people¹. The Norebang is divided up into several rooms. The audiences in the Norebang are also actively interacting with the singer like holding their hands up, shouting verses, and/or singing together. Inside the rooms there exist a music player and instruments which help such interactions. One of the most important factors that made Norebang a familiar place is the development of the musical instruments installed in the Norebang. In the past, the instruments had only limited functions such as simply playing the music using a laser disc.

The first digital musical instrument for Korean Karaoke was the ME-8800 made by the Youngpoong Company. Since the appearance of the ME-8800, the Korean Karaoke has become a more and more popular place². Due to the

digital nature of this instrument, several digital signal processing techniques could be incorporated into the system, of which one of the most popular services is the automatic lyrics progressing on the screen. From then on more and more digital services have been incorporated in the instrument. However, still the digital instruments lack in the interactive modes which could bring about more excitement in the Korean Karaoke. Therefore, in³, we proposed some interactive IT services for the Korean Karaoke. In this paper, we propose an interactive ambient lighting system based on the use of the Kinect sensor and the Neo-Pixel strip. The Kinect sensor senses the action of the singer which is then processed inside the digital component of the music instrument. Then, the ambient lighting is lighted according to the singer's action and the front screen color.

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2. Lighting in Korean Karaoke

2.1 Importance of Interaction in Korean Karaoke

In Korean Karaoke there exists a barrier between other rooms (Figure 1(a)). This makes each room closed to other rooms. But inside the room, there exists openness between people in the same room. People become very intimate to each other. This kind of culture also has something to do with the traditional group consciousness in Korea. Therefore, one reason that people go to Norebang is to increase the group consciousness which will lead to an Increment of the group's performance. Another reason for the popularity of the Korean Karaoke is the high competition in Korea. In Korea, there is a high competition and people got stress from the competition. The Korean Karaoke is a place where people can forget their stress and let the stress off. Furthermore, people come together and have some feeling that everyone is equal which makes them more relax. Therefore, the audiences in the Korean Karaoke are not passive but active and react together to the singer by applauding, shouting, dancing, and tapping the Tambourine or so (Figure 1(b)). Instruments in the Korean Karaoke are therefore designed to the aim to increase this kind of interaction.

2.2 Human-Computer Interaction Technologies

Human-computer interaction (HCI) researches study the use of computer technology on the interacting interfaces between human and computers⁴⁻⁸. Nowadays, there are many tools which make the HCI application easy. For example, the Kinect sensor is a good tool to capture the human actions and reflect it on a processing unit which then reacts to the action. We will use such interaction



Figure 1. Korean Karaoke (a) Barrier exists between the rooms (b) Inside the room there exists interaction with the singer.

between the instruments with the lighting system in the Korean Karaoke.

2.3 Conventional Lighting in Korean Karaoke

The lighting is an important tool to increase the immersion in the Korean Karaoke. However, conventional lighting in Korean Karaoke has no relation to the music or the singer's action. Therefore, the light often does not match the mood of the music. Conventional Korean Karaoke use a normal lighting cube which is attached on the ceiling and which turns around randomly (Figure 2). This gives Korean Karaoke an exciting mood. However, the conventional lighting often fails to fit the mood shown in the front screen, which also disturbs the immersion into the music.

2.4 Screen Ambient Lighting

In⁹, an ambient screen lighting using the Neo-Pixel strip has been proposed. The ambient lighting is behind the monitor of the computer and the lights are emitted according to the average RGB values in the screenshot. The screenshot is divided into 10 sections and the average RGB values are computed for each of the sections. Then, the Neo Pixel Strip emits different lights at 10 different positions to match the colors of the sections. Figure 3 shows a screenshot of the screen ambient lighting. The Neo Pixel strip emits ambient lights similar to the screen color. This gives an illusion that the screen is extended to the throughout the room. The ambient lighting is rather weak and can be observed only in a very dark environment. However, this fits the condition in the Korean Karaoke which is normally very dark. Furthermore, the ambient light can give a very calm feeling compared with the conventional lighting in the Korean Karaoke.



Figure 2. Conventional lighting systems in Korean Karaoke.



Figure 3. Ambient lighting which interacts with the screen (adopted from).

3. Proposed Work

This section proposes the Interactive lighting for the Korean Karaoke. The basic constitution consists of the all-around installation of the Neo-Pixel in the Korean Karaoke room.

3.1 Configuration of the Korean Karaoke with Ambient Lighting

The constitution of the Korean Karaoke with interactive ambient lighting is shown in Figure 4. The wall and the floor are installed with the Neo-Pixel strip all around the room. In the front, there is a screen which plays the music video as in conventional Korean Karaoke. Behind the screen there exists also a Neo-Pixel strip which emits several colors according to the colors of the music video. These colors are diffused throughout the room by the Neo-Pixel strip. When the singer takes an action (①) this becomes recorded by the Kinect camera which is installed on the top of the front screen (②). The incoming frame is analyzed by the processing software installed inside the digital music instrument (③). The processing software analyses the singer's position and action and sends signals to the Neo-Pixel strips corresponding to the singer's position which will emit bright lights or flashes through the Neo-Pixel strip (④). On the screen, the sizes of the characters of the lyrics are also actively changing according to the singer's action (⑤). Other interactive actions such as balloon exploding based on the singer's action can also be incorporated into the system.

3.2 Arrangement of the Neo-Pixel Lighting

The arrangement of the Neo-pixels is shown in Figure 5. The sections with the same numbers show the part of

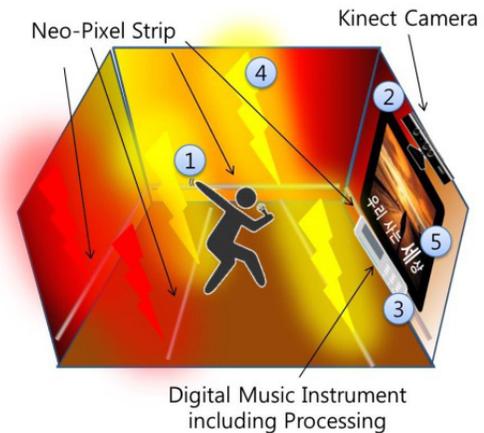


Figure 4. Constitution of Interactive Korean Karaoke.

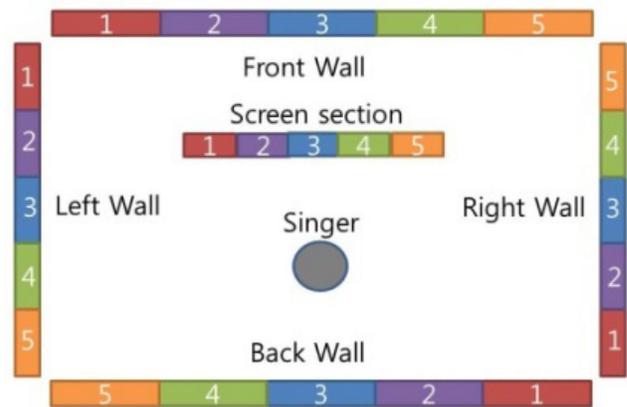


Figure 5. Configuration of the Neo-Pixel LED for Diffusive Ambient Lighting.

the strip which emits the same colors. This results in a continuous lighting throughout the room. The lighting positions are controlled by the Processing software. The arrangement is configured such that the colors show a continuous changing throughout the room.

3.3 Overall System Diagram

The key elements in the proposed system are an Arduino board, Kinect Camera, Neo-Pixel strip and the Processing software which does the image processing (Figure 6). Kinect is a motion sensing input device which enables users to control and interact with the computer. Arduino is an open-source hardware which can build digital devices and interactive objects. Processing is flexible software for visual arts. A Neo-Pixel strip is a strip of LED's which all have RGB components and where each LED can

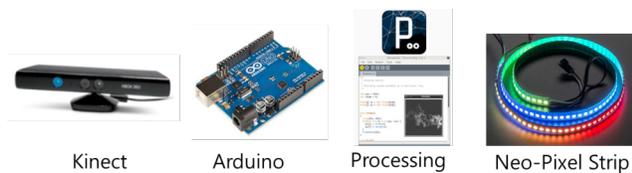


Figure 6. Key elements of the proposed interactive lighting in Korean Karaoke.

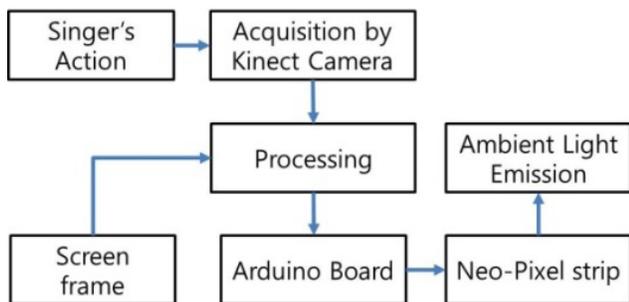


Figure 7. System diagram of the proposed method.



Figure 8. Simulation of the interactive lighting (a) Lighting according to the screen color changes. (b) Lighting according to the singer’s action.

Table 1. Survey on the feelings according to the Lighting

	Lighting Conditions		
	Conventional Lighting	Lighting according to the screen color	Lighting according to the Singer’s action
Degree of Immersion	73	93	82
Degree of Satisfaction	76	92	81
Degree of Exciting	84	84	91

be controlled separately. Due to the separate control of the LED’s, the position which should have lighting can be controlled, making the lighting to behave in an active mode.

Figure 7 shows the overall diagram of the proposed system. The processing software processes both the acquired action of the singer and the colors of the screen frame and convert them into the light and position information of the Neo-Pixel strip, where the Neo-pixel strip is controlled by the Arduino board.

Figure 8 shows the experiment results of the proposed system. Figure 8(a) shows the ambient lighting according to the colors of the music video clip played on the screen. Figure 8(b) shows the lighting to light in full brightness according to the singer’s action.

To make a subjective experiment, we took 10 people who gave each a score from 0~10 to the feeling of the various lighting systems. The total ranges from 0~100 for each term. The degree of immersion is the degree of feeling how much the singer feels to be absorbed into the music. The degree of satisfaction is the degree of how much the singer feels satisfied by the lighting system. The degree of exciting is the degree of how much exciting feelings the singer feels. The lighting according to the screen color gives a large score on the immersion into the music, while the singer feels more excited by the lighting that reacts according to the singer’s action. As shown in Table 1, the survey shows the possibility of the interactive lighting system to be of commercial value.

4. Conclusion

In this paper, we proposed an interactive ambient lighting system that acts according to the screen colors and the singer’s action. The proposed system gives the singer a deeper immersion into the song, which results in a higher satisfaction. Therefore, it is expected that the interactive system has a commercial value and can help to the promote the business of the Korean Karaoke.

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