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VitaLight—Light to Support Vital Signs †

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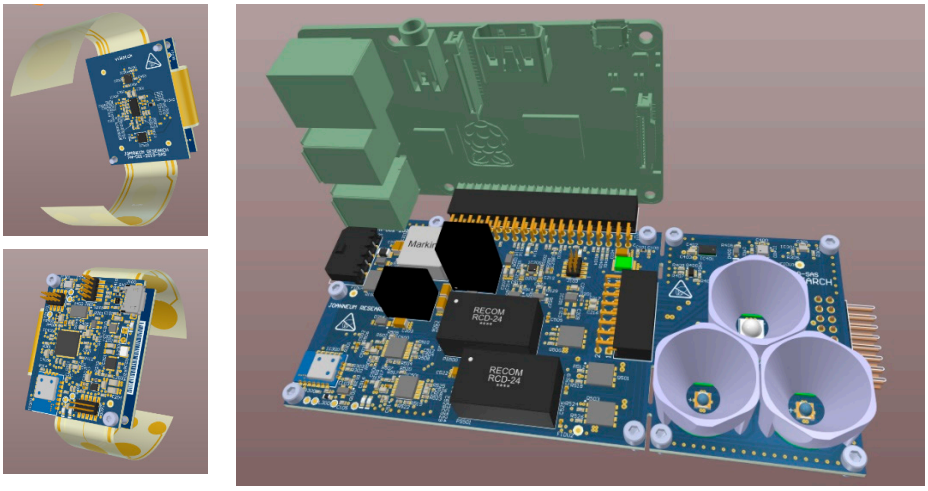
Abstract: The spectral composition of light has a significant influence on human wellbeing, emotion and health. Natural sunlight is often considered as the ideal light source in this regard. Therefore, artificial lighting solutions that mimic natural sunlight are a central research topic in the lighting industry. Another global trend is the monitoring and evaluation of the vital parameters of human beings to improve their health status and their personal lifestyle. Here, we present VitaLight, a laboratory sample for a smart lighting system that aims to interconnect these global trends and consists of VitaWatch, a wristband with functionally integrated sensors that is comfortable to wear on the body, and VitaLUMI, a lighting unit with access to the internet.

Keywords: health monitoring; blood pressure; smart lighting

1. Introduction

Throughout their evolution, human beings got accustomed to natural sunlight. Therefore, artificial lighting solutions that mimic natural sunlight are a central research topic in the lighting industry. Nevertheless, in terms of the non-visual effects of lighting on humans, not only the visible spectrum has to be considered, but also the infrared and the ultraviolet radiations are essential. Failure to consider these wavelengths may have negative consequences for wellbeing and health. For instance, recent studies have shown that high blood pressure can be actively lowered in the presence of UV radiation [1,2]. On the other hand, however, it is a fact that too much ultraviolet radiation can be very harmful and may cause skin cancer or eye damage. Therefore, it is essential to control the dose and duration of UV exposure as precisely as possible for the respective persons.

Today, many people also record their daily activities and health conditions using small and smart portable devices (e.g., heart rate monitoring, step counting, etc.) [3]. In this context, our vision is to use a small and smart portable device (VitaWatch—for the 3D model, see Figure 1) to record those vital parameters of an individual, which can be positively controlled by the tailored composition (color temperature, light intensity, infrared and ultraviolet radiation) of the lighting conditions. The information on these parameters is transmitted to a lighting unit (VitaLUMI—for the 3D model, see Figure 1), which, based on this information, adjusts its light composition accordingly.



(**a**) (**b**)

Figure 1. (**a**) 3D model of VitaWatch that can be easily worn on the body (wrist). Front view (**top**), rear view with direct contact to the skin (**bottom**), (**b**) 3D model of VitaLUMI.

2. Results

The electronic and ergonomic design of the sensor node (VitaWatch) is realized based on a rigid-flex printed circuit board, developed to be worn like a wristband on the human body. The VitaLUMI is designed using a multi-board concept (consisting of LED driver electronics, a set of sensors and an IoT gateway) based on medium- and high-power LEDs (for visible light, IR and UV radiations) with mixer control, analog and digital load current control and a Single Board Computer (Raspberry Pi 3 Model B +) as the electronic system control unit, respectively, the IoT interface.

Communication from the VitaWatch to the VitaLUMI is managed via a Bluetooth connection (Bluetooth Smart 5.0 (BLE)). For additional sensors (like GNSS), transducers (like Piezo-Buzzer), more offline memory space (e.g., µSD-Card) and a visual interface (via simple LED or a MIP-Display), an optional expansion board (piggyback-PCB) may be added (interconnected by pin-headers) at the top/front side. With the help of this set-up, one can record the actual blood pressure of a person, adjust the UV radiation of the luminaire accordingly and directly control its impact, while with the support of data from the internet, the total UV exposure can be also controlled.

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Conflicts of Interest: The authors declare no conflict of interest.

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