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(54) **OPTICAL DETECTION DEVICE FOR PHYSIOLOGICAL CHARACTERISTIC IDENTIFICATION**

(71) Applicant: **PixArt Imaging Inc.**, Hsin-Chu City (TW)

(72) Inventor: **Cheng-Nan Tsai**, Hsin-Chu City (TW)

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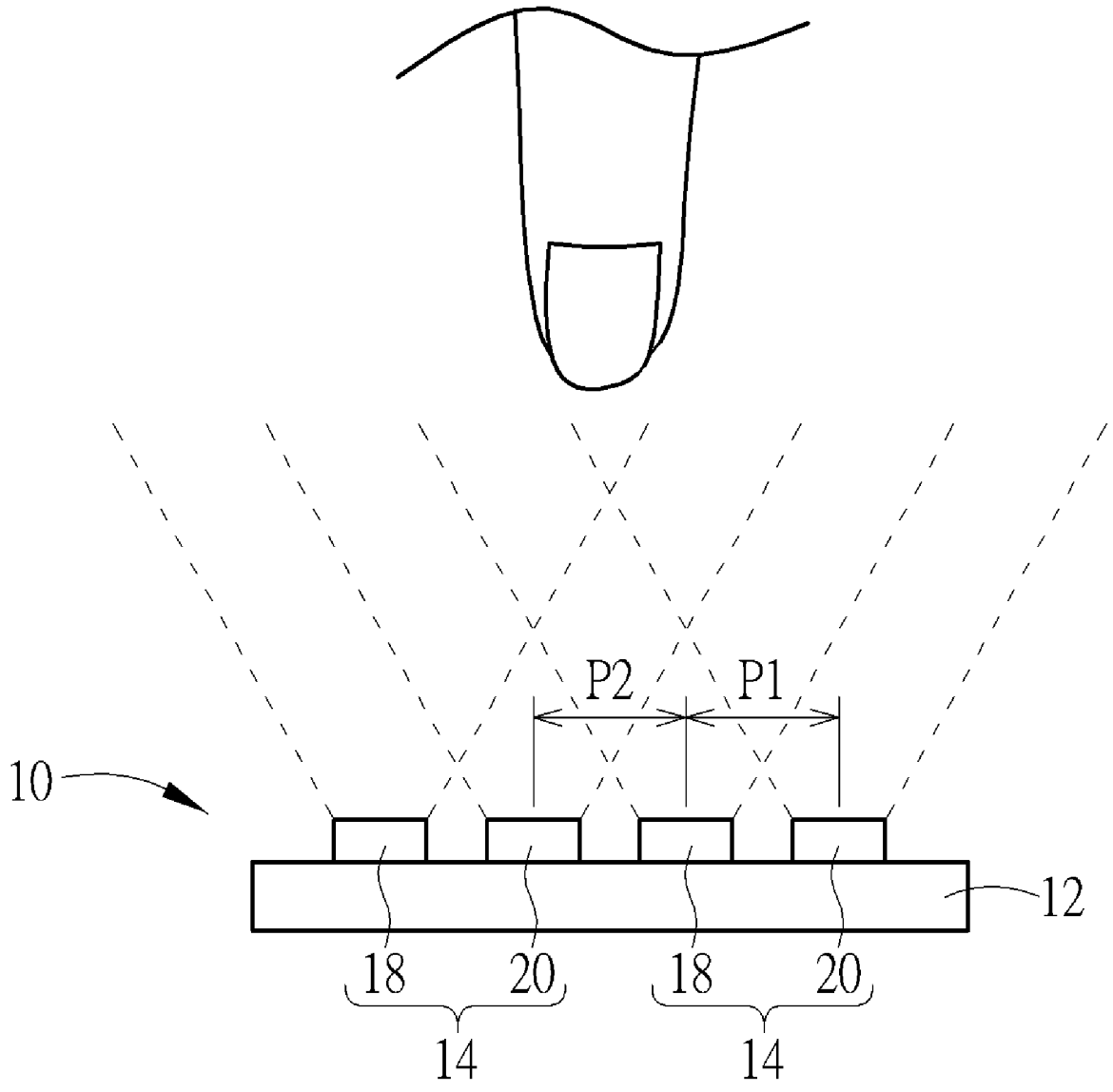
(57) **ABSTRACT**

An optical detection device for physiological characteristic identification includes a substrate, a light source and an optical receiver. The light source includes a plurality of first lighting units and a plurality of second lighting units symmetrically arranged on the substrate. The optical receiver is disposed on the substrate and adapted to analyze optical signals emitted by the light source for acquiring a result of the physiological characteristic identification.



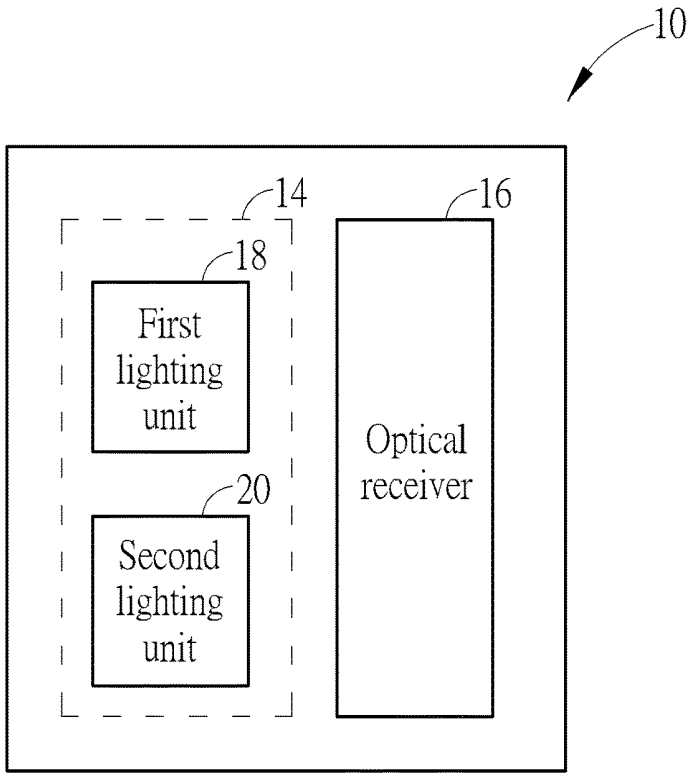

10
14
16
18
First lighting unit
20
Second lighting unit
Optical receiver

FIG. 1

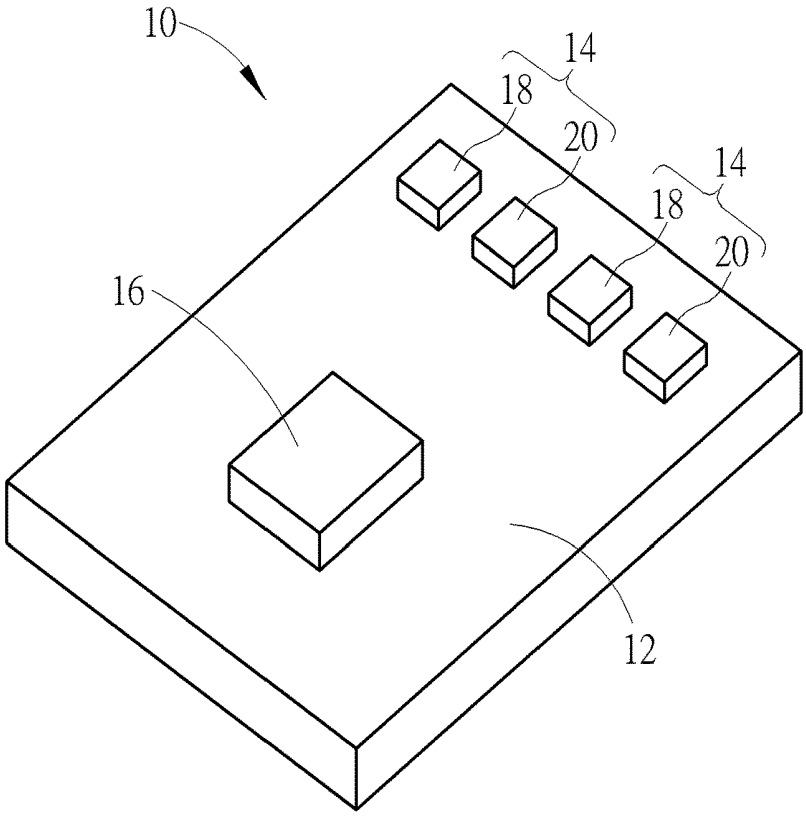

10
14
18
20
14
18
20
16
12

FIG. 2

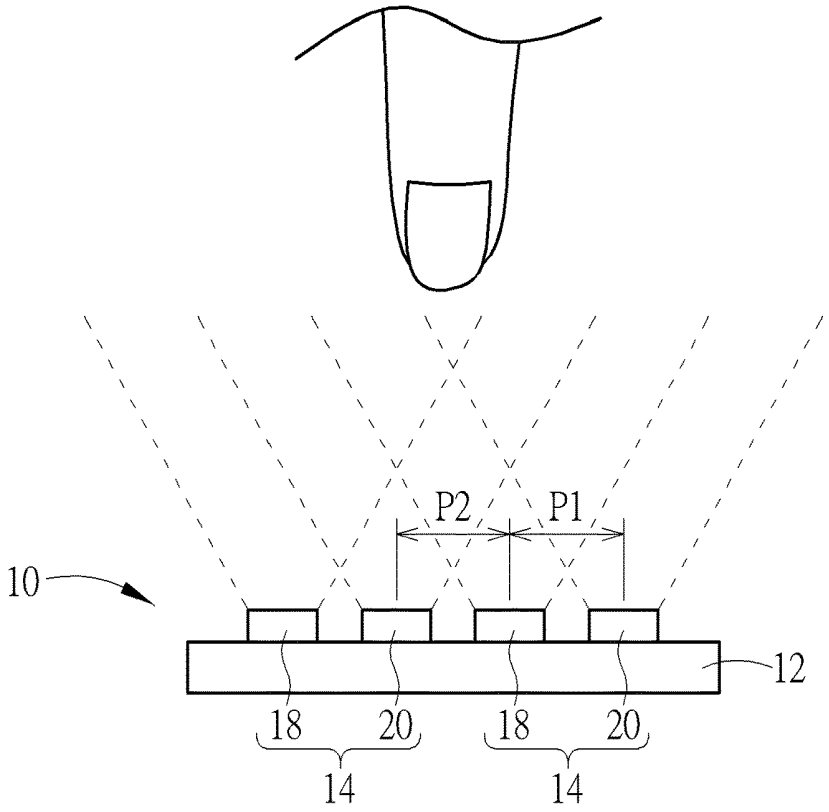


FIG. 3

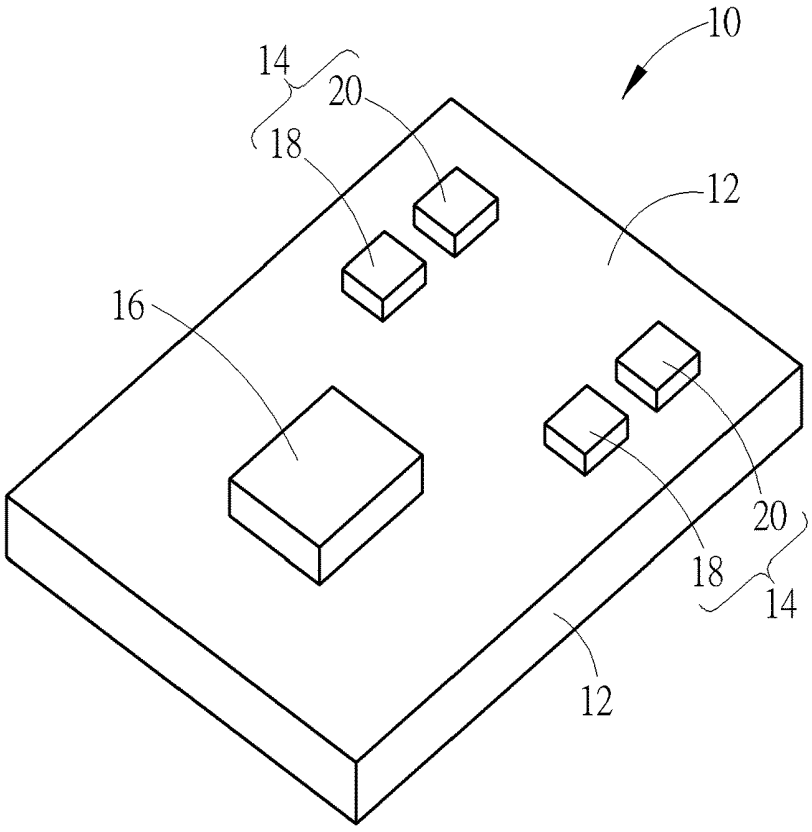


FIG. 4

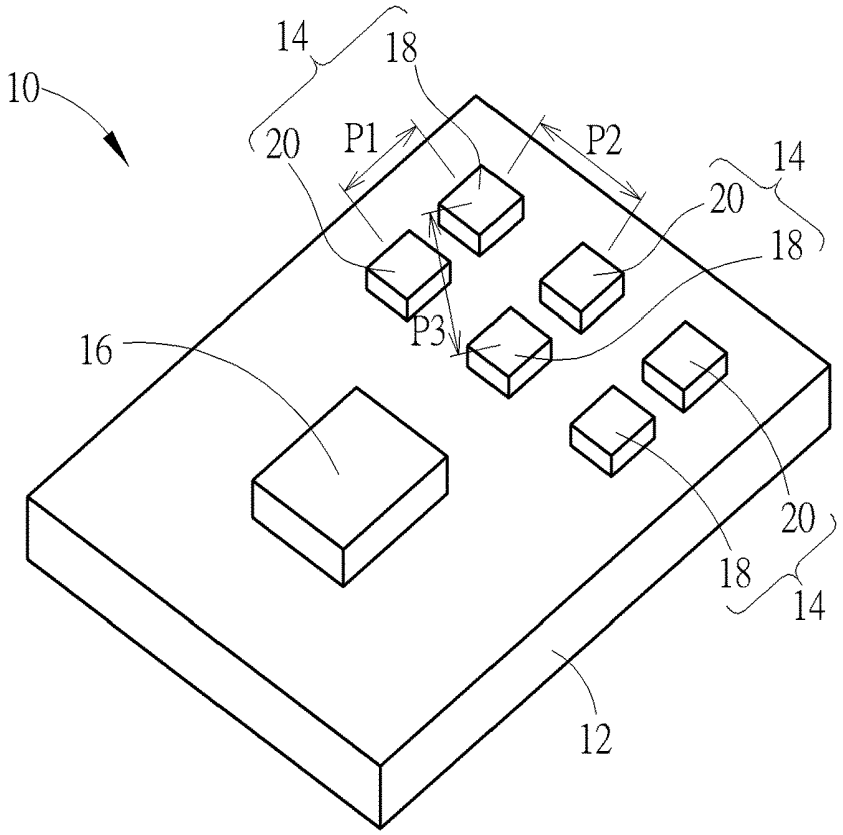

10
14
18
20
P1
P2
14
20
18
P3
16
20
18
14
12

FIG. 5

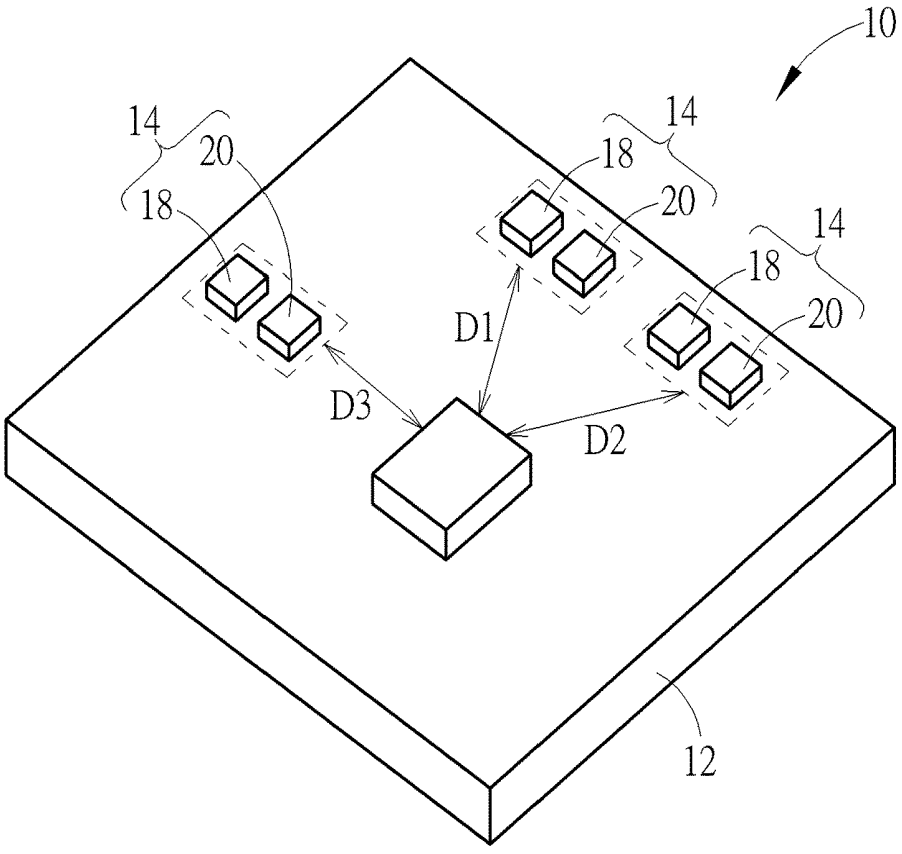

10
14
20
18
14
18
20
14
18
20
D1
D3
D2
12

FIG. 6

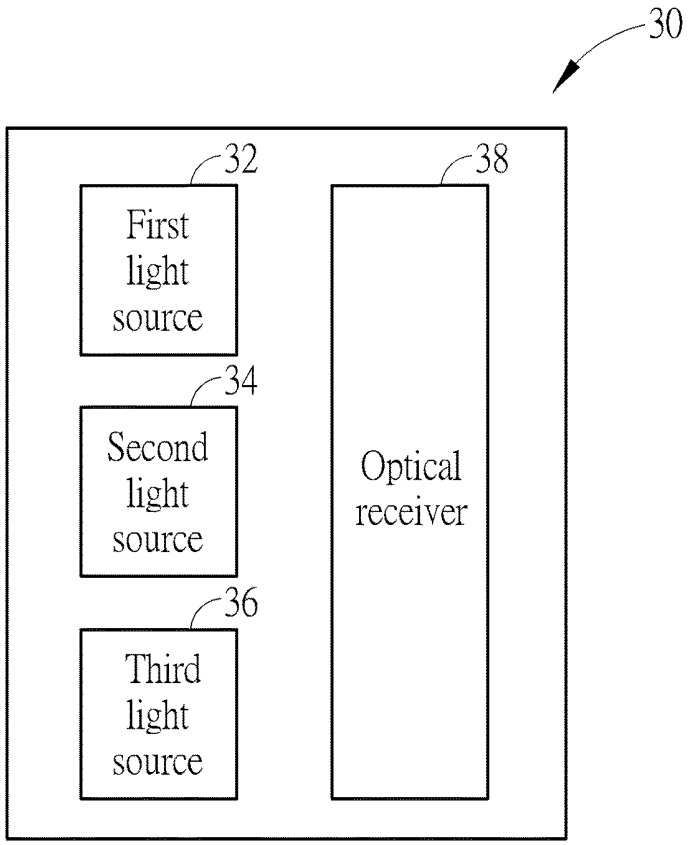

30
32
First light source
34
Second light source
36
Third light source
38
Optical receiver

FIG. 7

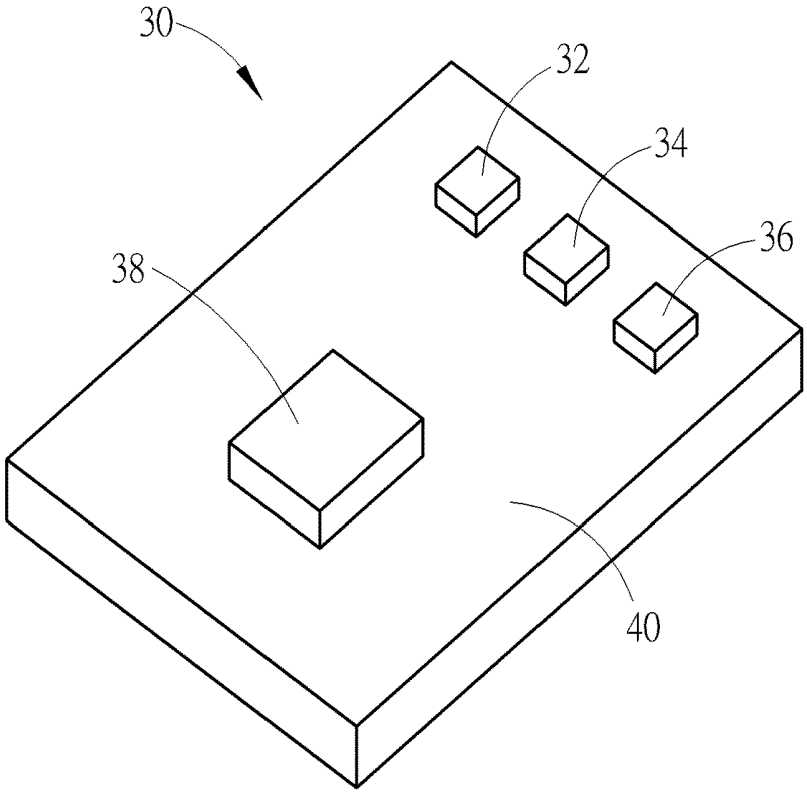

30
32
34
36
38
40

FIG. 8

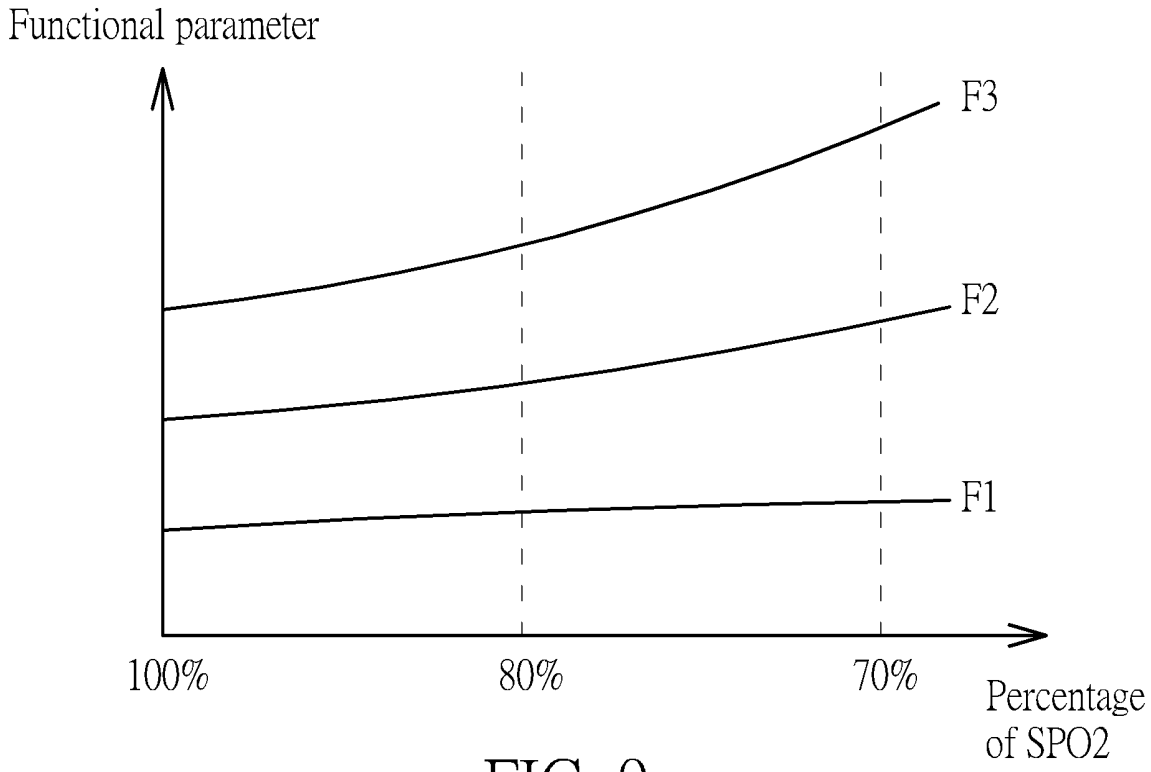

Functional parameter
F3
F2
F1
100%
80%
70%
Percentage of SPO2

FIG. 9

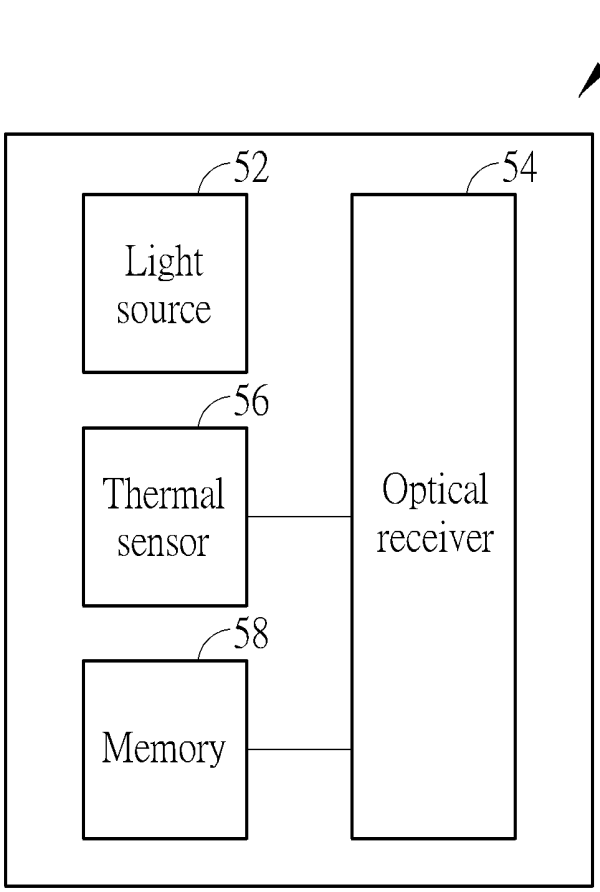

50
52
54
Light source
56
Thermal sensor
Optical receiver
58
Memory

FIG. 10

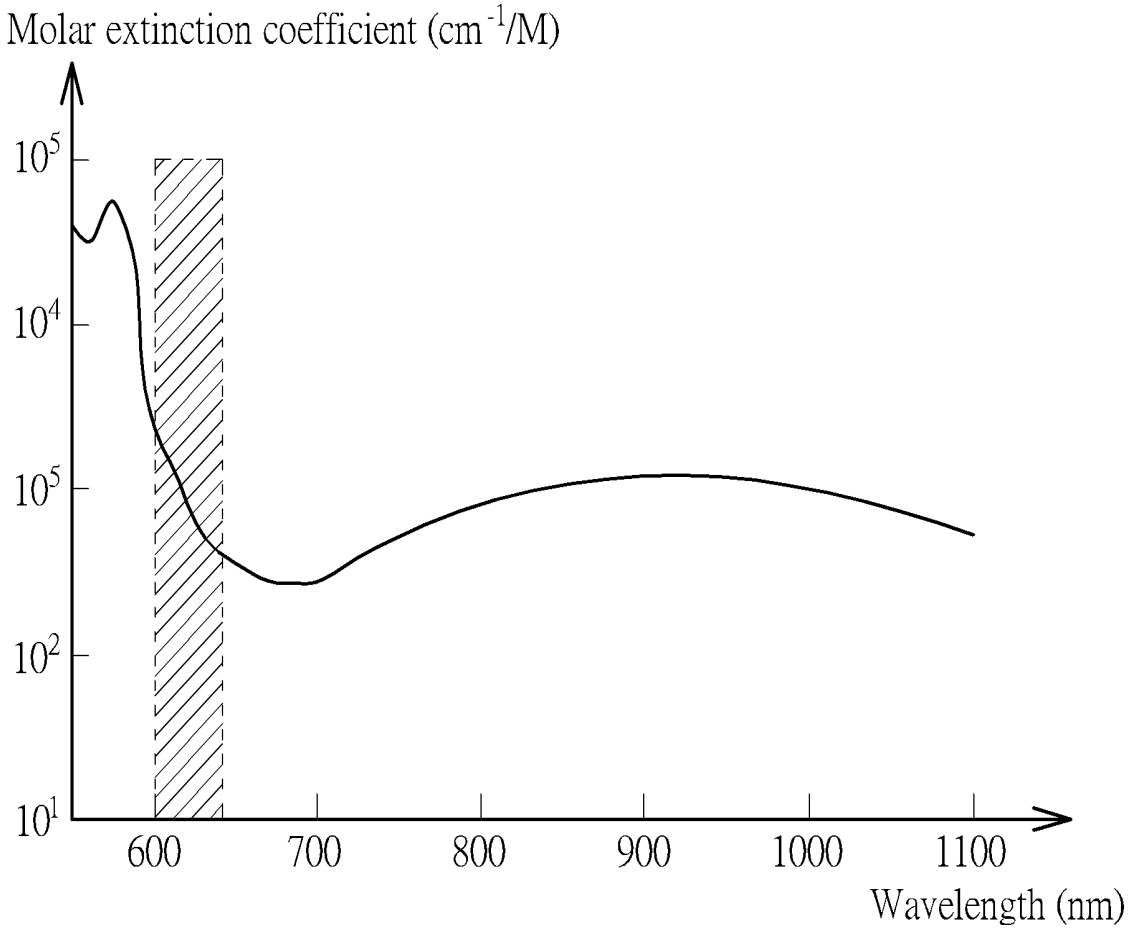

Molar extinction coefficient (cm-1/M)
10^5
10^4
10^5
10^2
10^1
600
700
800
900
1000
1100
Wavelength (nm)

FIG.11

OPTICAL DETECTION DEVICE FOR PHYSIOLOGICAL CHARACTERISTIC IDENTIFICATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an optical detection device, and more particularly, to an optical detection device for preferred physiological characteristic identification.

2. Description of the Prior Art

[0002] A conventional optical detection device utilizes an optical signal having a wavelength about 660 nm, 880 nm or 940 nm to detect physiological characteristics (Oxygenated Hemoglobin, HbO2) of the user. Generally, the user may put a finger on the conventional optical detection device for the physiological characteristic identification; however the conventional optical detection device may be designed as a smart wearable device, such as the smart watch, the smart bracelet and the smart necklace. The wrist and the neck cannot provide sufficient signal intensity of the physiological characteristic identification, that is, a design of an optical detection device capable of increasing optical detecting efficiency is an important issue in the related industry.

SUMMARY OF THE INVENTION

[0003] The present invention provides an optical detection device for preferred physiological characteristic identification for solving above drawbacks.

[0004] According to the claimed invention, an optical detection device for physiological characteristic identification includes a substrate, a light source and an optical receiver. The light source includes a plurality of first lighting units and a plurality of second lighting units symmetrically arranged on the substrate. The optical receiver is disposed on the substrate and adapted to analyze optical signals emitted by the light source for acquiring a result of the physiological characteristic identification.

[0005] According to the claimed invention, an optical detection device for physiological characteristic identification includes a first light source, a second light source, a third light source and an optical receiver. The first light source is adapted to emit a first optical signal. The second light source is adapted to emit a second optical signal. The third light source is adapted to emit a third optical signal. The optical receiver is adapted to receive and analyze the first optical signal, the second optical signal and the third optical signal for acquiring a result of the physiological characteristic identification. The first optical signal, the second optical signal and the third optical signal have wavelengths different from each other.

[0006] According to the claimed invention, an optical detection device for physiological characteristic identification includes a light source and an optical receiver. The light source is adapted to emit an optical signal having a wavelength ranged of 600 to 630 nm. The optical receiver is adapted to receive and analyze the optical signal for acquiring a result of the physiological characteristic identification.

[0007] The present invention utilizes several ways to improve the result of the physiological characteristic identification. The optical detection device may utilize one optical signal with the wavelength ranged around 600 to 630 nm, or utilize two optical signals emitted by the lighting units arranged in symmetry, or utilize three optical signals having the wavelengths different from each other to detect the physiological characteristics for the preferred detection result.

[0008] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a functional block diagram of an optical detection device according to a first embodiment of the present invention.

[0010] FIG. **2** is a schematic diagram of the optical detection device according to the first embodiment of the present invention.

[0011] FIG. **3** is another view of the optical detection device shown in FIG. **2**.

[0012] FIG. **4** and FIG. **5** are schematic diagrams of the optical detection device in various applications according to the first embodiment of the present invention.

[0013] FIG. **6** is a schematic diagram of the optical detection device in another application according to the first embodiment of the present invention.

[0014] FIG. **7** is a functional block diagram of an optical detection device according to a second embodiment of the present invention.

[0015] FIG. **8** is a schematic diagram of the optical detection device according to the second embodiment of the present invention.

[0016] FIG. **9** is a diagram of functional curves between different optical signals according to the second embodiment of the present invention.

[0017] FIG. **10** is a functional block diagram of an optical detection device according to a third embodiment of the present invention.

[0018] FIG. **11** is a diagram of coefficient variation detected by the optical detection device according to the third embodiment of the present invention.

DETAILED DESCRIPTION

[0019] Please refer to FIG. **1** to FIG. **3**. FIG. **1** is a functional block diagram of an optical detection device **10** according to a first embodiment of the present invention. FIG. **2** is a schematic diagram of the optical detection device **10** according to the first embodiment of the present invention. FIG. **3** is another view of the optical detection device **10** shown in FIG. **2**. The optical detection device **10** can include a substrate **12**, a light source **14** and an optical receiver **16**. The light source **14** can utilize at least one first lighting unit **18** and at least one second lighting unit **20** to project optical signals onto the user's skin for physiological characteristic identification. The first lighting unit **18** and the second lighting unit **20** have different wavelengths and preferably are plural, and the plurality of first lighting units **18** and the plurality of second lighting units **20** are symmetrically arranged on the substrate **12**. The optical receiver **16** can be disposed on the substrate **12** and adjacent to the light source **14**. The optical receiver **16** can analyze the optical signals reflected from the user's skin for acquiring a result of the physiological characteristic identification.

[0020] In the first embodiment, the plurality of first lighting units **18** are interlaced with the plurality of second lighting units **20**, and a pitch P1 between one first lighting unit **18** and one second lighting unit **20** is the same as a pitch P2 between the foresaid first lighting unit **18** and another second lighting unit **20**. Accordingly, the pitch between one second lighting unit **20** and one first lighting unit **18** is the same as the pitch between the foresaid second lighting unit **20** and another first lighting unit **18**. The optical signals generated by the first lighting unit **18** and the second lighting unit **20** are divergent beams. As the first lighting unit **18** and the second lighting unit **20** are symmetrically arranged, the optical signals of the first lighting units **18** and the second lighting units **20** projected onto the user's skin are overlapped to establish a region having mixed beams with different wavelengths, so as to eliminate diversity of projection positions between the first lighting unit **18** and the second lighting unit **20**, and to acquire the preferred result of the physiological characteristic identification.

[0021] An amount and an arrangement of the first lighting unit **18** and the second lighting unit **20** are not limited to the above-mentioned embodiment, and depend on design demand. As shown in FIG. **3**, a central region above the optical detection device **10** can gather the beams emitted by the first lighting units **18** and the second lighting units **20** uniformly. The user may put the finger or the wrist or the neck on the central region above the optical detection device **10**, and the optical receiver **16** can acquire a preferred reflection pattern for the physiological characteristic identification.

[0022] Please refer to FIG. **4** and FIG. **5**. FIG. **4** and FIG. **5** are schematic diagrams of the optical detection device **10** in various applications according to the first embodiment of the present invention. As shown in FIG. **4**, each light source **14** is consisted of one first lighting unit **18** and one second lighting unit **20**, and the optical detection device **10** can dispose a plurality of light sources **14** on a side of the optical receiver **16**. A symmetrical arrangement about the first lighting units **18** and the second lighting units **20** can represent an arrangement about one first lighting unit **18** and one second lighting unit **20** (such as the right-side light source **14**) is a mirror image of another arrangement about another first lighting unit **18** and another second lighting unit **20** (such as the left-side light source **14**). The optical detection device **10** can acquire the preferred result of the physiological characteristic identification if a large number of the light sources **14** is uniformly disposed adjacent to the optical receiver **16**; for example, a distance between the optical receiver **16** and a center of the right-side light source **14** is the same as a distance between the optical receiver **16** and a center of the left-side light source **14**.

[0023] As shown in FIG. **5**, each light source **14** is consisted of one first lighting unit **18** and one second lighting unit **20**, and a symmetrical arrangement about the first lighting units **18** and the second lighting units **20** can represent an arrangement about one first lighting unit **18** and one second lighting unit **20** (such as the middle light source **14**) is able to take the place of another arrangement about another first lighting unit **18** and another second lighting unit (such as the right-side light source **14** or the left-side light source **14**) in response to the previously-mentioned arrangement (which means the middle light source **14**) turned one hundred and eighty degrees. In addition, the pitch P1 between one first lighting unit **18** and one second lighting unit **20** is the same as the pitch P2 between the foresaid first lighting unit **18** and another second lighting unit **20**, and the pitch P1 and the pitch P2 is smaller than a pitch P3 between the foresaid first lighting unit **18** and another first lighting unit **18**, which means the plurality of first lighting units **18** and the plurality of second lighting units **20** can be symmetrically arranged as a matrix. Numeral of columns and rows of the matrix is not limited to the embodiment shown in FIG. **5**.

[0024] Please refer to FIG. **6**. FIG. **6** is a schematic diagram of the optical detection device **10** in another application according to the first embodiment of the present invention. Several sets (such as the light sources **14** shown in FIG. **6**) consisted of one first lighting unit **18** and one second lighting unit **20** are established, and each set has parameters relevant to the optical receiver **16** is similar to another set's parameters relevant to the optical receiver **16**. For example, the symmetrical arrangement about the first lighting units **18** and the second lighting units **20** can represent that a distance Dl between the optical receiver **16** and a set of the first lighting unit **18** and the second lighting unit **20** is the same as or similar to another distance D2 and D3 between the optical receiver **16** and a set of another first lighting unit **18** and another second lighting unit **20**. The light sources **14** can be disposed around the first lighting units **18** as long as the distances between the optical receiver **16** and each light source **14** are similar even the same.

[0025] According to the above-mentioned application of the first embodiment, the plurality of light sources **14** can be disposed adjacent to the same side of the optical receiver **16** or disposed around several sides of the optical receiver **16** for the symmetrical arrangement. Each light source **14** can have one or plural sets consisted of one first lighting unit **18** and one second lighting unit **20**, which depends on its structural strength. The distance between the optical receiver **16** and the plural sets containing the first lighting unit **18** and the second lighting unit **20** preferably are the same or similar to each other. Furthermore, a distance between the optical receiver **16** and an arrangement center of the light sources **14** may be preferably ranged of 5 to 15 mm.

[0026] Please refer to FIG. **7** to FIG. **9**. FIG. **7** is a functional block diagram of an optical detection device **30** according to a second embodiment of the present invention. FIG. **8** is a schematic diagram of the optical detection device **30** according to the second embodiment of the present invention. FIG. **9** is a diagram of functional curves between different optical signals according to the second embodiment of the present invention. The optical detection device **30** can include a first light source **32**, a second light source **34**, a third light source **36**, an optical receiver **38** and a substrate **40**. The first light source **32**, the second light source **34** and the third light source **36** are disposed on the substrate **40** and adjacent to the optical receiver **38**. The first light source **32**, the second light source **34** and the third light source **36** are used to respectively emit a first optical signal, a second optical signal and a third optical signal, respectively having wavelengths different from each other. For instance, the wavelength of the first optical signal may be ranged about 660 nm, and the wavelength of the second optical signal may be ranged about 880 nm, and the wavelength of the third optical signal may be in the range of 660 to 880 nm.

[0027] The optical receiver **38** may have a built-in processor or receive a processing result from an external component; therefore, the optical receiver **38** can analyze the

first optical signal, the second optical signal and the third optical signal reflected from the user's skin to detect physiological characteristics of the user, such as Oxygenated Hemoglobin (HbO2). Relation between the first optical signal and the second optical signal can generate a first function F1; relation between the first optical signal and the third optical signal can generate a second function F2; relation between the second optical signal and the third optical signal can generate a third function F3. The first function F1, the second function F2 and the third function F3 are varied accordingly when the first optical signal, the second optical signal and the third optical signal are projected onto the pressed biological organization, and the optical receiver **38** can receive and analyze the functions F1, F2 and F3 to determine what information is reasonable for following analysis and what information is unreasonable for being removed, so as to acquire the high-precision result of the physiological characteristic identification. The said functions can be a ratio of one of the optical signals to another optical signal, or an equation relevant to two of the optical signals.

[0028] Please refer to FIG. **10** and FIG. **11**. FIG. **10** is a functional block diagram of an optical detection device **50** according to a third embodiment of the present invention. FIG. **11** is a diagram of coefficient variation detected by the optical detection device **50** according to the third embodiment of the present invention. The optical detection device **50** can include a light source **52** and an optical receiver **54**. The light source **52** can be utilized to emit an optical signal having a wavelength ranged of 600 to 630 nm. The optical receiver **54** can analyze the foresaid optical signal reflected from the biological organization to acquire the result of the physiological characteristic identification. The conventional optical detection technology utilizes the optical signal with a wavelength ranged about 660 nm but cannot acquire sufficient signal intensity for identification analysis; for this reason, the optical detection device **50** which utilizes the optical signal having the wavelength ranged around 600 to 630 nm can effectively increase the signal intensity, as an area with inclined lines shown in FIG. **11**, so as to acquire the preferred result of the physiological characteristic identification.

[0029] The optical detection device **50** can further include a thermal sensor **56** and a memory **58** both are electrically connected to the optical receiver **54**. The optical detection device **50** can actuate the thermal sensor **56** to sense ambient temperature or temperature of an electronic unit, and compensate the result of the physiological characteristic identification in accordance with a sensing result of the thermal sensor **56** for increasing an accuracy of the physiological characteristic identification. For instance, the electronic unit can be an integrated circuit or any heat generating components nearby the optical detection device **50**. The memory **58** can be used to store relation between the sensed temperature and the result of the physiological characteristic identification. As temperature variation is sensed, a compensating parameter of the physiological characteristic identification can be searched from a look-up table about the said relation stored in the memory **58**, and the compensating parameter is applied to amend the result of the physiological characteristic identification for overcoming inaccuracy resulted by the optical signal with the wavelength ranged around 600 to 630 nm.

[0030] In conclusion, the present invention utilizes several ways to improve the result of the physiological characteristic identification. The optical detection device may utilize one optical signal with the wavelength ranged around 600 to 630 nm, or utilize two optical signals emitted by the lighting units arranged in symmetry, or utilize three optical signals having the wavelengths different from each other to detect the physiological characteristics for the preferred detection result.

[0031] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

What is claimed is:

1. An optical detection device for physiological characteristic identification, comprising:

a substrate;

a light source, comprising a plurality of first lighting units and a plurality of second lighting units symmetrically arranged on the substrate; and

an optical receiver disposed on the substrate and adapted to analyze optical signals emitted by the light source for acquiring a result of the physiological characteristic identification.

2. The optical detection device of claim **1**, wherein the plurality of first lighting units and the plurality of second lighting units are arranged as a matrix, and the plurality of first lighting units are interlaced with the plurality of second lighting units.

3. The optical detection device of claim **1**, wherein a pitch between a first lighting unit and any of the second lighting units is the same.

4. The optical detection device of claim **1**, wherein a pitch between a first lighting unit and any of the second lighting units is smaller than a pitch between the first lighting unit and another first lighting unit.

5. The optical detection device of claim **1**, wherein a symmetrical arrangement about the plurality of first lighting units and the plurality of second lighting units represents an arrangement about a first lighting unit and a second lighting unit is a mirror image of an arrangement about another first lighting unit and another second lighting unit.

6. The optical detection device of claim **1**, wherein a symmetrical arrangement about the plurality of first lighting units and the plurality of second lighting units represents an arrangement about a first lighting unit and a second lighting unit is able to take the place of an arrangement about another first lighting unit and another second lighting unit in response to the previously-mentioned arrangement turned one hundred and eighty degrees.

7. The optical detection device of claim **1**, wherein a symmetrical arrangement about the plurality of first lighting units and the plurality of second lighting units represents a distance between the optical receiver and a set of a first lighting unit and a second lighting unit is the same as a distance between the optical receiver and a set of another first lighting unit and another second lighting unit.

8. The optical detection device of claim **1**, wherein a distance between the optical receiver and a center of the light source is ranged of 5 to 15 mm.

9. An optical detection device for physiological characteristic identification, comprising:

a first light source adapted to emit a first optical signal;

a second light source adapted to emit a second optical signal;

a third light source adapted to emit a third optical signal; and

an optical receiver adapted to receive and analyze the first optical signal, the second optical signal and the third optical signal for acquiring a result of the physiological characteristic identification;

wherein the first optical signal, the second optical signal and the third optical signal have wavelengths different from each other.

10. The optical detection device of claim **9**, wherein the wavelength of the first optical signal is ranged about 660 nm, the wavelength of the second optical signal is ranged about 880 nm, and the wavelength of the third optical signal is in the range of 660 to 880 nm.

11. The optical detection device of claim **9**, wherein the optical receiver is adapted to analyze variation between the first optical signal and the second optical signal, between the first optical signal and the third optical signal, and between the second optical signal and the third optical signal for acquiring the result.

12. The optical detection device of claim **11**, wherein the variation is an equation relevant to two of the foresaid optical signals, or a ratio of one optical signal to another optical signal.

13. An optical detection device for physiological characteristic identification, comprising:

a light source adapted to emit an optical signal having a wavelength ranged of 600 to 630 nm; and

an optical receiver adapted to receive and analyze the optical signal for acquiring a result of the physiological characteristic identification.

14. The optical detection device of claim **13**, further comprising:

a thermal sensor electrically connected to the optical receiver and adapted to sense ambient temperature or temperature of an electronic unit for compensating the result of the physiological characteristic identification.

15. The optical detection device of claim **14**, further comprising:

a memory electrically connected to the optical receiver and used to store relation between the sensed temperature and the result for compensation.

* * * * *

专利名称(译)	用于生理特征识别的光学检测装置		
公开(公告)号	US20200163551A1	公开(公告)日	2020-05-28
申请号	US16/202022	申请日	2018-11-27
[标]申请(专利权)人(译)	原相科技股份有限公司		
申请(专利权)人(译)	PIXART IMAGING INC.		
当前申请(专利权)人(译)	PIXART IMAGING INC.		
[标]发明人	TSAI CHENG NAN		
发明人	TSAI, CHENG-NAN		
IPC分类号	A61B5/00		
CPC分类号	A61B2562/0271 A61B2560/0252 A61B5/0059 A61B2562/0233 A61B5/0075 A61B5/14552 A61B5/681 A61B2562/0242		
外部链接	Espacenet USPTO		

摘要(译)

一种用于生理特征识别的光学检测装置，包括基板，光源和光接收器。光源包括对称地布置在基板上的多个第一照明单元和多个第二照明单元。 光接收器设置在基板上，并适于分析由光源发出的光信号，以获取生理特征识别的结果。