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(54) **Digital diagnostic system and host**

Digitales Diagnosesystem und Aufnahmegerät

Système de diagnostic numérique et hôte

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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to a digital diagnostic system, and more particularly to a host with interchangeable optical lenses, an optical lens module, and a digital diagnostic system including the same.

DESCRIPTION OF THE PRIOR ART

[0002] A digital diagnostic system of prior art is composed of a host and a lens which are combined into one body. Therefore, it's necessary that a doctor uses a corresponding digital diagnostic system to observe different affected parts, such as ophthalmic fundus, ear canal, or skin etc., which results in that whole costs cannot be reduced.

[0003] Another digital diagnostic system of prior art is designed to be a host with detachable lenses so that a doctor may use one host to observe various affected parts of a patient with different kinds of lenses. However, in the digital diagnostic system of prior art, optical lenses with curved surfaces and coupled with each other are respectively arranged at the host end and the lens end. To couple various lenses for different purposes with the host, the optical design of the system is more complicated. Alternatively, it increases manufacturing difficulty for arranging a focus adjustment mechanism with higher precision, such as a cam ring, at the lens end. In a digital diagnostic system disclosed by US patent No. 5,879,289 or US patent No. 6,319,199 B1, the light source is arranged at the host end. US-A-2005/0043588 discloses a medical instrument having various removable modular nose portions and including both image capture device and light source disposed in the removable portion. EP-A-2 289 391 relates to a medical inspection device comprising a hand-held module, a display module and an inspection module detachably coupled to the display module.

[0004] Accordingly, it is highly desirable to simplify the optical design of a digital diagnostic system, which makes single host to be coupled with various lenses for different purposes and provides an image with better image quality.

SUMMARY OF THE INVENTION

[0005] The present invention proposes a host, an optical lens module, and a digital diagnostic system including the same, wherein the host without an optical lens with a curved surface simplifies the optical design of the lens end. In addition, the host end includes a focus adjustment module for driving an image capture module, which compensates the differences of focal length between various optical lens modules. Therefore, the optical design of the lens end can be simplified, and the system allows a greater mechanism tolerance to reduce manufacturing difficulty and manufacturing cost.

[0006] In one embodiment of the present invention, the proposed digital diagnostic system comprises a host and at least one optical lens module. The host includes an image capture module, a display module, a processing unit, a focus adjustment module, a plurality of first conductive contacts, an adapter, and a power module. The image capture module is used for capturing a reflected light from an affected part to form an image. The display module is used for displaying the image captured by the image capture module. The processing unit is electrically connected to the image capture module and the display module, and the processing unit is used for processing the image and displaying the image on the display module. The focus adjustment module is used for driving the image capture module to linearly move along an image capturing direction. The adapter is arranged in front of the image capture module. The power module supplies power to the digital diagnostic system in operation. The optical lens module is detachably connected to the adapter, and comprises a plurality of optical lenses, a light source and a plurality of second conductive contacts. The plurality of optical lenses has a plurality of curved surfaces and is used for converging the reflected light on the image capture module. The light source is positioned off an optical axis of the optical lens and is used for providing illumination light to illuminate the affected part. The plurality of second conductive contacts is used for electrically connecting to the corresponding first conductive contacts to supply power to the light source when the optical lens module is connected to the adapter.

[0007] In another embodiment of the present invention, the proposed host composes a digital diagnostic system with at least one optical lens module. The host comprises an image capture module, a display module, a processing unit, a focus adjustment module, a plurality of first conductive contacts, an adapter, and a power module. The image capture module is used for capturing a reflected light from an affected part to form an image. The display module is used for displaying the image captured by the image capture module.

The processing unit is electrically connected to the image capture module and the display module, and the processing unit is used for processing the image and displaying the image on the display module. The focus adjustment module is used for driving the image capture module to linearly move along an image capturing direction. The adapter is arranged in front of the image capture module for connecting the optical lens module so that the optical lens module can converge the reflected light on the image capture module. The power module supplies power to the digital diagnostic system in operation. The plurality of first conductive contacts is used for electrically connecting to a plurality of corresponding second conductive contacts of the optical lens module to supply power to a light source of the optical lens module when the optical

lens module is connected to the adapter.

[0008] In yet another embodiment of the present invention, the proposed optical lens module composes the digital diagnostic system with a host without an optical lens with a curved surface, wherein the host comprises a plurality of first conductive contacts, an adapter and an image capture module linearly moving along an image capturing direction. The optical lens module is detachably connected to the adapter of the host and comprises a plurality of optical lenses, a light source and a plurality of second conductive contacts. The optical lenses have a plurality of curved surfaces for converging a reflected light from an affected part on the image capture module of the host to form an image. The light source is positioned off an optical axis of the optical lens for providing illumination light to illuminate the affected part. The plurality of second conductive contacts is used for electrically connecting to the corresponding first conductive contacts to supply power to the light source when the optical lens module is connected to the adapter.

[0009] The objective, technologies, features and advantages of the present invention will become apparent from the following description in conjunction with the accompanying drawings wherein certain embodiments of the present invention are set forth by way of illustration and example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The foregoing conceptions and their accompanying advantages of this invention will become more readily appreciated after being better understood by referring to the following detailed description, in conjunction with the accompanying drawings, wherein:

Fig. 1 is a diagram schematically illustrating a host of a digital diagnostic system according to an embodiment of the present invention;

Fig. 2a and Fig. 2b are diagrams schematically illustrating a plurality of optical lens modules of a digital diagnostic system according to an embodiment of the present invention;

Fig. 3 is a block diagram illustrating a host of a digital diagnostic system according to an embodiment of the present invention; and

Fig. 4 is a block diagram illustrating a host and a base of a digital diagnostic system according to an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] The detailed explanation of the present invention is described as follows. The described preferred embodiments are presented for purposes of illustrations and description, and they are not intended to limit the scope of the present invention.

[0012] Referring to Figs. 1, 2 and 3, an embodiment of a digital diagnostic system according to the present invention comprises a host (10) and at least one optical lens module (20a, 20b, 20c, 20d and 20e). The host (10) comprises an image capture module (101), a display module (102), a processing unit (103), a focus adjustment module (104), an adapter (112), and a power module (105). The image capture module (101) is used for capturing a reflected light (701) from an affected part (70) to form an image. The display module (102) is used for displaying the image captured by the image capture module (101). The processing unit (103) is electrically connected to the image capture module (101) and the display module (102). The processing unit (103) is used for processing the image captured by the image capture module (101) and displaying the image on the display module (102). For example, the processing unit (103) processes the image captured by the image capture module (101) such as eliminating noise, adjusting contrast, or adjusting brightness, to get better image quality.

[0013] The focus adjustment module (104) is used for driving the image capture module (101) to linearly move along an image capturing direction presented by an arrow A shown in Fig. 2a. For example, to find the appropriate focal length, a user may utilize an exposed adjusting ring (104a) on exterior part of the host (10) to drive the image capture module (101) to move backwards and forwards along the direction of arrow A. It is noted that the focus adjustment module (104) can be driven by manual and electrical operation. The adapter (112) is arranged in front of the image capture module (101) so that the optical lens module (20a, 20b, 20c, 20d or 20e) can be detachably connected to the adapter (112). For example, the optical lens module (20a, 20b, 20c, 20d or 20e) may be clamped with or screw on the adapter (112). The optical lens module (20a, 20b, 20c, 20d or 20e) connected to the adapter (112) is coupled to the image capture module (101) so that the reflected light (701) of the affected part (70) is converged on the image capture module (101) to form the image. The power module (105) is used for supplying power to the digital diagnostic system in operation. The power module (105) may be a primary or rechargeable battery. In one embodiment of the present invention, the host (10) comprises a charging circuit (106) which is electrically connected to the power module (105). When the host (10) is electrically connected to an external power supply (50), the charging circuit (106) can utilize the external power supply (50) for charging the power module (105).

[0014] Referring to Fig. 2a and Fig. 2b, in one embodiment of the present invention, the optical lens module (20a, 20b, 20c, 20d or 20e) comprises a plurality of optical lenses (201) and a light source (202). A lens set including the plurality of lenses (201) has a plurality of curved faces so that the reflected light (701) of the affected part (70) can converge on the image capture module (101). The light source (202) is positioned off an optical axis of the optical lens (201). The light source (202) provides an illumination light (202a) for illuminating the affected part (70). In a preferred embodiment of the present invention,

the optical lens module (20a, 20b, 20c, 20d or 20e) further comprises a diaphragm (203) arranged between the optical lenses (201). The diaphragm (203) arranged in interior of the optical lens module (20a, 20b, 20c, 20d or 20e) can increase symmetry for reducing some odd-order aberrations of an image and enhancing image quality.

[0015] It is noted that, by appropriate design, different kinds of optical lens modules (20a, 20b, 20c, 20d, 20e) can be used for inspecting various affected part (70). For example, the light source (202) can be specially designed to emit the illumination light (202a) onto fundus oculi of an eye effectively. Alternatively, a contact plate (204) with a specific refraction rate can be arranged on the optical lens module (20b) shown in Fig. 2a to make greater part of the illumination light (202a) emit into an inner layer of skin so that the ratio of the illumination light (202a) reflected by the skin can be reduced. Furthermore, in order to provide illumination for the inside of a long and narrow channel, such as a ear canal, the optical lens module (20c) shown in Fig. 2a may utilize an optical element such as a collimator to guide the illumination light (202a) emitted from the light source (202) into an optical fiber (202b), and thereby the illumination light (202a) is emitted from the other end of the optical fiber (202b) to the inside of the long and narrow channel. It is noted that the optical lens module is not limited to these embodiments described above. For example, the optical lens module may be an ophthalmoscope lens, an otoscope lens, a dermatoscope lens, a microcirculation scope lens, a rhinoscope lens (such as the optical lens module (20d) shown in Fig. 2b), a laryngoscope lens (such as the optical lens module (20e) shown in Fig. 2b), or an endoscopy lens, etc. Be additionally noted, the light source (202) of the optical lens module (20d, 20e) shown in Fig. 2b, the illumination light (202a) is suitably guided to the affected part (70) by appropriate design. For example, the illumination light (202a) emitted from the light source (202) may be reflected within an optical fiber or an inner wall of a tube to the affected part (70). Alternatively, it may utilize an optical fiber (205) to collect the reflected light from the affected part to the image capture module as presented by the optical lens module (20e) shown in Fig. 2b.

[0016] In one embodiment of the present invention, the host (10) comprises a plurality of first conductive contacts (113), and the optical lens module (20a, 20b, 20c, 20d or 20e) comprises a plurality of second conductive contacts (not shown). When the optical lens module (20a, 20b, 20c, 20d or 20e) is connected to the adapter (112) of the host (10), the plurality of second conductive contacts of the optical lens module are electrically connected to the corresponding first conductive contacts (113) of the host (10) so that the light source (202) of the optical lens module can be electrically connected to the power module (105) of the host (10), thus the power is acquired for emitting a illumination light. In one embodiment of the present invention, the processing unit (103) determines a type of the optical lens module connected to the adapter (112) according to a connected configuration of the first conductive contacts (113). For example, if there are four first conductive contacts (113), one of them is grounding and the other three first conductive contacts (113) are arranged as a vector to obtain a combination of $2\times2\times2$. The optical lens module has seven configurations for identification except that optical lens module is not connected. In a preferred embodiment of the present invention, the processing unit (103) can further set the mode of the image capture module (101) and adjust the internal setting value to obtain better image quality.

[0017] According to the above-mentioned structure, the interior of the host (10) does not have any optical lens, i.e. it does not include any optical lens with curved surfaces. Therefore, an external optical lens module is independently designed to be maximized and optimized. In one embodiment of the present invention, the host (10) comprises a cover plate (not shown) arranged between the image capture module (101) and the adapter (112), which is for protecting the image capture module (101). In addition, the focus adjustment module (104) is independently arranged in interior of the host (10) for driving the image capture module (101) to linearly move, that means the back focus of the optical lens module can be capable of optionally adjusting. Therefore, the optical lens module does not need any other mechanism for adjusting focal length, particularly a designed cam ring for nonlinear compensation, so that the optical design of the optical lens module can be further simplified, and the system allows a greater mechanism tolerance to reduce manufacturing difficulty and manufacturing cost.

[0018] Referring to Fig. 3, in one embodiment of the present invention, the host (10) further comprises a storage unit (107) which is electrically connected to the processing unit (103). The storage unit (107) is used for storing images captured by the image capture module (101) so that a doctor's human errors in sketching an affected part on a paper can be reduced. The storage unit (107) may be a flash memory, a hard disk, or a combination thereof. For example, the storage unit (107) may be a memory card.

[0019] In one embodiment of the present invention, the host (10) further comprises an image output interface (108) which is electrically connected to the processing unit (103). The image output interface (108) is used for connecting an external display device (30) to the digital diagnostic system of the present invention therethrough so that patients under treatment can synchronously observe the image of the affected part.

[0020] In one embodiment of the present invention, the host (10) further comprises a communication interface (109) which is electrically connected to the processing unit (103). The communication interface (109) is used for connecting an external electronic device (40) to the digital diagnostic system of the present invention therethrough. Hence, diagnostic data stored in the digital diagnostic system of the present invention can be transmitted to the external electronic device (40) via the communication interface (109). For example, the communication interface

(109) may be universal serial bus (USB) interface; and the external electronic device (40) may be a computer.

[0021] In one embodiment of the present invention, the host (10) further comprises a microphone (110) electrically connected to the processing unit (103). The microphone (110) is used for receiving a voice from a user (such as a doctor) and converting the voice into an audio signal. The audio signal acquired by the microphone (110) can be stored in the storage unit (107) to record the voice from the user so that it provides convenience for data trace and analysis. In a preferred embodiment of the present invention, the host (10) further comprises a speaker (111) electrically connected to the processing unit (103). The speaker (111) is used for outputting the audio signal acquired by the microphone (110) to avoid inconvenience of transmitting audio signal or connecting an external speaker.

[0022] Referring to Fig. 4, in one embodiment, the proposed digital diagnostic system comprises a base (60) having a first connection port (601) and a second connection port (602). The first connection port (601) is used for electrically connecting, respectively or simultaneously, to at least one of the image output interface (108), the communication interface (109), and the charging circuit (106) of the host (10). The second connection port (602) is used for electrically connecting to at least one of the external display device (30), the external electronic device (40), and the external power supply (50). Therefore, the host (10) can be electrically connected to the external display device (30), the external electronic device (40), or the external power supply (50) via the base (60). It is noted, in the embodiment shown in Fig. 3 and Fig. 4, the charging circuit (106) is arranged in the host (10), but not limited to the embodiment, the charging circuit (106) may be also arranged in the base (60).

[0023] In conclusion, the host end of the digital diagnostic system according to the present invention does not have any optical lens with curved surface so that the optical design of the lens end can be greatly simplified. In addition, the host includes the focus adjustment module driving the image capture module to linearly move to compensate differences of focal length between various optical lens modules, and hence it's not necessary to arrange a focus adjustment mechanism in the lens end. Therefore, the optical design of the optical lens module can be further simplified, and the system allows a greater mechanism tolerance to reduce manufacturing difficulty and manufacturing cost.

[0024] While the invention is susceptible to various modifications and alternative forms, a specific example thereof has been shown in the drawings and is herein described in detail. It should be understood, however, that the invention is not to be limited to the particular form disclosed, but to the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the appended claims.

Claims

1. A digital diagnostic system, comprising:

a host (10) which comprises:

an image capture module (101), for capturing a reflected light (701) from an affected part (70) to form an image;
a display module (102), for displaying the image captured by the image capture module (101);
a processing unit (103) electrically connected to the image capture module (101) and the display module (102), for processing the image and displaying the image on the display module (102);
a focus adjustment module (104), for driving the image capture module (101) to linearly move along an image capturing direction;
a plurality of first conductive contacts (113);
an adapter (112) arranged in front of the image capture module (101); and
a power module (105), for supplying power to the digital diagnostic system in operation; and

at least one optical lens module (20a, 20b, 20c, 20d, 20e) detachably connected to the adapter (112), wherein the optical lens module (20a, 20b, 20c, 20d, 20e) comprises:

a plurality of optical lenses (201) having a plurality of curved surfaces, for converging the reflected light (701) on the image capture module (101);
a light source (202) positioned off an optical axis of the optical lens (201), for providing illumination light (202a) to illuminate the affected part (70); and
a plurality of second conductive contacts, for electrically connecting to the corresponding first conductive contacts (113) to supply power to the light source (202) when the optical lens module (20a, 20b, 20c, 20d, 20e) is connected to the adapter (112).

2. The digital diagnostic system according to claim 1, wherein the optical lens module (20a, 20b, 20c, 20d, 20e) further comprises a diaphragm (203) arranged between the optical lenses (201).

3. The digital diagnostic system according to claim 1, wherein the plurality of second conductive contacts are electrically connected to the corresponding first conductive contacts (113) to allow the processing unit (103) to determine a type of the optical lens module (20a, 20b, 20c, 20d, 20e) according to a connect-

ed configuration of the first conductive contacts (113) when the optical lens module (20a, 20b, 20c, 20d, 20e) is connected to the adapter (112).

4. The digital diagnostic system according to claim 1, further comprising:

a base (60) comprising a first connection port (601) and a second connection port (602); wherein the first connection port (601) is used for electrically connecting to at least one of an image output interface (108), an communication interface (109), and a charging circuit (106) of the digital diagnostic system; and the second connection port (602) is used for electrically connecting to at least one of an external display device (30), an external electronic device (40), and an external power supply (50).

5. A host (10) for composing a digital diagnostic system with at least one optical lens module (20a, 20b, 20c, 20d, 20e) comprising a light source (202) and a plurality of second conductive contacts, comprising:

an image capture module (101), for capturing a reflected light (701) from an affected part (70) to form an image;
a display module (102), for displaying the image captured by the image capture module (101),
a processing unit (103) electrically connected to the image capture module (101) and the display module (102), for processing the image and displaying the image on the display module (102);
a focus adjustment module (104), for driving the image capture module (101) to linearly move along an image capturing direction;
an adapter (112) arranged in front of the image capture module (101), for connecting the optical lens module (20a, 20b, 20c, 20d, 20e) to converge the reflected light (701) on the image capture module (101);
a power module (105), for supplying power to the digital diagnostic system in operation; and
a plurality of first conductive contacts (113), for electrically connecting to the corresponding second conductive contacts to supply power to the light source (202) when the optical lens module (20a, 20b, 20c, 20d, 20e) is connected to the adapter (112).

6. The host (10) according to claim 5, wherein the optical lens module (20a, 20b, 20c, 20d, 20e) comprises a plurality of second conductive contacts; and the plurality of second conductive contacts are electrically connected to the corresponding first conductive contacts (113) to allow the processing unit (103) to determine a type of the optical lens module (20a, 20b, 20c, 20d, 20e) according to a connected configuration of the first conductive contacts (113) when the optical lens module (20a, 20b, 20c, 20d, 20e) is connected to the adapter (112).

7. The host (10) according to claim 5, further comprising:

a storage unit (107) electrically connected to the processing unit (103), for storing the image captured by the image capture module (101).

8. The host (10) according to claim 5, further comprising:

an image output interface (108) electrically connected to the processing unit (103), for connecting an external display device (30) to the digital diagnostic system therethrough.

9. The host (10) according to claim 5, further comprising:

a communication interface (109) electrically connected to the processing unit (103), for connecting an external electronic device (40) to the digital diagnostic system therethrough.

10. The host (10) according to claim 5, further comprising:

a microphone (110) electrically connected to the processing unit (103), for receiving a voice from a user and converting the voice into an audio signal.

11. The host (10) according to claim 10, further comprising:

a speaker (111) electrically connected to the processing unit (103), for outputting the audio signal.

12. The host (10) according to claim 5, further comprising:

a cover plate arranged between the image capture module (101) and the adapter (112), for protecting the image capture module (101).

13. The host (10) according to claim 5, further comprising:

a charging circuit (106) electrically connected to the power module (105), for charging the power module (105) with an external power supply (50).

Patentansprüche

1. Digitales Diagnosesystem umfassend:

einen Host (10), umfassend:

eine Bilderfassungseinheit (101) zum Erfassen eines reflektierten Lichts (701) von einer betroffenen Stelle (70), um ein Bild zu erzeugen;
eine Bildschirmeinheit (102) zum Anzeigen des von der Bilderfassungseinheit (101) erfassten Bilds;
eine Rechnereinheit (103), die elektrisch mit der Bilderfassungseinheit (101) und der Bildschirmeinheit (102) zum Verarbeiten des Bilds und zum Anzeigen des Bilds auf der Bildschirmeinheit (102) verbunden ist;
eine Einheit zum Einstellen der Bildschärfe (104), welche die Bilderfassungseinheit (101) dazu antreibt, sich linear entlang einer Bilderfassungsrichtung zu bewegen;
eine Vielzahl von ersten leitfähigen Kontakten (113);
einen vor der Bilderfassungseinheit (101) angeordneten Adapter (112); und
eine Stromversorgungseinheit (105) für die Stromversorgung des digitalen Diagnosesystems im Betrieb; und
mindestens ein optisches Linsenmodul (20a, 20b, 20c, 20d, 20e), das lösbar mit dem Adapter (112) verbunden ist, wobei das optische Linsenmodul (20a, 20b, 20c, 20d, 20e) umfasst:

eine Vielzahl von optischen Linsen (201) mit einer Vielzahl von gekrümmten Oberflächen zum Konvergieren des reflektierten Lichts (701) auf die Bilderfassungseinheit (101);
eine abseits einer optischen Achse der optischen Linse (201) positionierte Lichtquelle (202) zur Bereitstellung von Beleuchtungslicht (202a), um die betroffene Stelle (70) zu beleuchten; und
eine Vielzahl von zweiten leitfähigen Kontakten zum elektrischen Verbinden mit den entsprechenden ersten leitfähigen Kontakten (113), um die Lichtquelle (202) mit Strom zu versorgen, wenn das optische Linsenmodul (20a, 20b, 20c, 20d, 20e) mit dem Adapter verbunden ist (112).

2. Digitales Diagnosesystem gemäß Anspruch 1, wobei das optische Linsenmodul (20a, 20b, 20c, 20d, 20e) ferner eine zwischen den optischen Linsen (201) angeordnete Scheidewand (203) umfasst.

3. Digitales Diagnosesystem gemäß Anspruch 1, wobei die Vielzahl der zweiten leitfähigen Kontakten elektrisch mit den entsprechenden ersten leitfähigen Kontakten (113) verbunden ist, um der Rechnereinheit (103) zu ermöglichen, einen Typ des optischen Linsenmoduls (20a, 20b, 20c, 20d, 20e) entsprechend einer angeschlossenen Konfiguration der ersten leitfähigen Kontakte (113) zu bestimmen, wenn das optische Linsenmodul (20a, 20b, 20c, 20d, 20e) mit dem Adapter (112) verbunden ist.

4. Digitales Diagnosesystem gemäß Anspruch 1, ferner umfassend:

einen Sockel (60), der einen ersten Verbindungsanschluss (601) und einen zweiten Verbindungsanschluss (602) umfasst;
wobei der erste Verbindungsanschluss (601) für die elektrische Verbindung zu mindestens einem von einer Bildausgabeschnittstelle (108), einer Kommunikationsschnittstelle (109) und einer Ladeschaltung (106) des digitalen Diagnosesystems verwendet wird; und der zweite Verbindungsanschluss (602) für die elektrische Verbindung mit mindestens einem von einer externen Anzeigevorrichtung (30), einer externen elektronischen Vorrichtung (40) und einer externen Stromversorgung (50) verwendet wird.

5. Host (10) zum Zusammenstellen eines digitalen Diagnosesystems mit mindestens einem optischen Linsenmodul (20a, 20b, 20c, 20d, 20e), das eine Lichtquelle (202) und eine Vielzahl von zweiten leitfähigen Kontakten umfasst, umfassend:

eine Bilderfassungseinheit (101) zum Erfassen eines reflektierten Lichts (701) von einer betroffenen Stelle (70), um ein Bild zu erzeugen;
eine Bildschirmeinheit (102) zum Anzeigen des von der Bilderfassungseinheit (101) erfassten Bilds;
eine Rechnereinheit (103), die elektrisch mit der Bilderfassungseinheit (101) und der Bildschirmeinheit (102) zum Verarbeiten des Bilds und zum Anzeigen des Bilds auf der Bildschirmeinheit (102) verbunden ist;
eine Einheit zum Einstellen der Bildschärfe (104), die die Bilderfassungseinheit (101) dazu antreibt, sich linear entlang einer Bilderfassungsrichtung zu bewegen;
einen vor der Bilderfassungseinheit (101) angeordneten Adapter (112) zum Verbinden mit dem optischen Linsenmodul (20a, 20b, 20c, 20d, 20e), um das reflektierte Licht (701) auf die Bilderfassungseinheit (101) zu konvergieren;
eine Stromversorgungseinheit (105) für die Stromversorgung des digitalen Diagnosesystems im Betrieb; und

eine Vielzahl von ersten leitfähigen Kontakten (113) zum elektrischen Verbinden mit den entsprechenden zweiten leitfähigen Kontakten, um die Lichtquelle (202) mit Strom zu versorgen, wenn das optische Linsenmodul (20a, 20b, 20c, 20d, 20e) mit dem Adapter (112) verbunden ist.

6. Host (10) gemäß Anspruch 5, wobei das optische Linsenmodul (20a, 20b, 20c, 20d, 20e) eine Vielzahl von zweiten leitfähigen Kontakten umfasst; und die Vielzahl der zweiten leitfähigen Kontakten elektrisch mit den entsprechenden ersten leitfähigen Kontakten (113) verbunden ist, um der Rechnereinheit (103) zu ermöglichen, einen Typ des optischen Linsenmoduls (20a, 20b, 20c, 20d, 20e) entsprechend einer angeschlossenen Konfiguration der ersten leitfähigen Kontakte (113) zu bestimmen, wenn das optische Linsenmodul (20a, 20b, 20c, 20d, 20e) mit dem Adapter (112) verbunden ist.

7. Host (10) gemäß Anspruch 5, ferner umfassend:

eine elektrisch mit der Rechnereinheit (103) verbundene Speichereinheit (107) zum Speichern des von der Bilderfassungseinheit (101) erfassten Bilds.

8. Host (10) gemäß Anspruch 5, ferner umfassend:

eine elektrisch mit der Rechnereinheit (103) verbundene Bildausgabeschnittstelle (108) zum Verbinden einer externen Anzeigevorrichtung (30) mit dem digitalen Diagnosesystem durch diese.

9. Host (10) gemäß Anspruch 5, ferner umfassend:

eine elektrisch mit der Rechnereinheit (103) verbundene Kommunikationsschnittstelle (109) zum Verbinden einer externen Vorrichtung (40) mit dem digitalen Diagnosesystem durch diese.

10. Host (10) gemäß Anspruch 5, ferner umfassend:

ein elektrisch mit der Rechnereinheit (103) verbundenes Mikrofon (110) zum Empfangen einer Stimme eines Anwenders und zum Umwandeln der Stimme in ein Audiosignal.

11. Host (10) gemäß Anspruch 10, ferner umfassend:

einen elektrisch mit der Rechnereinheit (103) verbundener Lautsprecher (111) zum Abgeben des Audiosignals.

12. Host (10) gemäß Anspruch 5, ferner umfassend:

eine zwischen der Bilderfassungseinheit (101) und dem Adapter (112) angeordnete Abdeckung zum Schützen der Bilderfassungseinheit (101).

13. Host (10) gemäß Anspruch 5, ferner umfassend:

eine elektrisch mit der Stromversorgungseinheit (105) verbundene Ladeschaltung (106) zum Aufladen der Stromversorgungseinheit (105) durch eine externe Stromversorgung (50).

Revendications

1. Un système de diagnostic numérique comprenant:

un hôte (10) qui comprend
un module de capture d'image (101) qui capture une lumière réfléchie (701) à partir d'une pièce affectée (70) pour former une image;
un module d'affichage (102) pour afficher l'image capture par le module de capture d'image (101);
une unité de traitement (103) connectée électriquement au module de capture d'image (101) et le module d'affichage (102) pour traiter l'image et afficher l'image sur le module d'affichage (102);
un module d'ajustement de la mise au point (104) pour commander le module de capture d'image (101) pour un déplacement linéaire le long d'une direction de capture d'image;
une pluralité de premiers contacts conducteurs (113);
un adaptateur (112) placé devant le module de capture d'image (101); et
un module d'alimentation (105) qui alimente en électricité le système de diagnostic numérique en cours de fonctionnement; et
au moins un module de lentille optique (20a, 20b, 20c, 20d, 20e) connecté de manière détachable à l'adaptateur (112) dans lequel le module de lentille optique (20a, 20b, 20c, 20d, 20e) comprend:

une pluralité de lentilles optiques (201) ayant une pluralité de surfaces incurvées pour converger la lumière réfléchie (701) sur le module de capture d'image (101);
une source lumineuse (202) positionnée en dehors d'un axe optique de la lentille optique (201) pour fournir une lumière d'illumination (202a) pour illuminer la pièce affectée (70); et
une pluralité de seconds contacts conducteurs pour la connexion électrique aux premiers contacts conducteurs correspondants (113) pour l'alimentation électrique de

la source lumineuse (202) lorsque le module de lentille optique (20a, 20b, 20c, 20d, 20e) est connecté à l'adaptateur (112).

2. Le système de diagnostic numérique selon la revendication 1 dans lequel le module de lentille optique (20a, 20b, 20c, 20d, 20e) comprend également un diaphragme (203) placé entre les lentilles optiques (201).

3. Le système de diagnostic numérique selon la revendication 1 dans lequel la pluralité de seconds contacts conducteurs sont connectés électriquement aux premiers contacts conducteurs correspondants (113) pour permettre à l'unité de traitement (103) de déterminer un type de module de lentille optique (20a, 20b, 20c, 20d, 20e) selon une configuration connectée des premiers contacts conducteurs (113) lorsque le module de lentille optique (20a, 20b, 20c, 20d, 20e) est connecté à l'adaptateur (112).

4. Le système de diagnostic numérique selon la revendication 1 comprenant également:

une base (60) comprenant un premier port de connexion (601) et un second port de connexion (602);
dans laquelle le premier port de connexion (601) est utilisé pour la connexion électrique à au moins une interface de sortie d'image (108), une interface de communication (109) et un circuit de charge (106) du système de diagnostic digital et le second port de connexion (602) est utilisé pour la connexion électrique à au moins un appareil d'affichage externe (30), un appareil électronique externe (40) et une alimentation électrique externe (50).

5. Un hôte (10) qui comprend un système de diagnostic numérique avec au moins un module de lentille optique (20, 20b, 20c, 20d, 20e) comprenant une source lumineuse (202) et une pluralité de seconds contacts conducteurs, comprenant:

un module de capture d'image (101) pour capturer une lumière réfléchie (701) à partir d'une pièce affectée (70) pour former une image;
un module d'affichage (102) pour afficher l'image capturée par le module de capture d'image (101),
une unité de traitement (103) connectée électriquement au module de capture d'image (101) et le module d'affichage (102) pour le traitement de l'image et l'affichage de l'image sur le module d'affichage (102);
un module d'ajustement de la mise au point (104) pour commander le module de capture d'image (101) pour un déplacement linéaire le long d'une direction de capture d'image;
un adaptateur (112) placé devant le module de capture d'image (101) pour la connexion du module de lentille optique (20a, 20b, 20c, 20d, 20e) pour converger la lumière réfléchie (701) sur le module de capture d'image (101);
un module d'alimentation (105) qui alimente en électrique le système de diagnostic numérique en cours de fonctionnement; et
une pluralité de premiers contacts conducteurs (113) pour la connexion électrique aux seconds contacts conducteurs correspondants pour alimenter en électrique la source lumineuse (202) lorsque le module de lentille optique (20a, 20b, 20c, 20d, 20e) est connecté à l'adaptateur (112).

6. L'hôte (10) selon la revendication 5 dans lequel le module de lentille optique (20a, 20b, 20c, 20d, 20e) comprend une pluralité de second contacts conducteurs et la pluralité des seconds contacts conducteurs sont connectés électriquement aux premiers contacts conducteurs correspondants (113) pour permettre l'unité de traitement (103) pour déterminer un type de module de lentille optique (20a, 20b, 20c, 20d, 20e) selon une configuration connectée des premiers contacts conducteurs (113) lorsque le module de lentille optique (20a, 20b, 20c, 20d, 20e) est connecté à l'adaptateur (112).

7. L'hôte (10) selon la revendication 5 comprenant également:

une unité de stockage (107) connectée électriquement à l'unité de traitement (103) pour stocker l'image capture par le module de capture d'image (101).

8. L'hôte (10) selon la revendication 5 comprenant également:

une interface de sortie d'image (108) connectée électriquement à l'unité de traitement (103) pour la connexion d'un appareil d'affichage externe (30) au système de diagnostic numérique à travers celui-ci.

9. L'hôte (10) selon la revendication 5 comprenant également:

une interface de communication (109) connectée électriquement à l'unité de traitement (103) pour la connexion d'un appareil électronique externe (40) au système de diagnostic numérique à travers celui-ci.

10. L'hôte (10) selon la revendication 5 comprenant également:

un micro (110) connecté électriquement à l'unité de traitement (103) pour la réception d'un signal vocal par un utilisateur et convertir le signal vocal en signal audio.

11. L'hôte (10) selon la revendication 10 comprenant également:

un haut-parleur (111) connecté électriquement à l'unité de traitement (103) pour sortir le signal audio.

12. L'hôte (10) selon la revendication 5 comprenant également:

une plaque de couverture placée entre le module de capture d'image (101) et l'adaptateur (112) pour protéger le module de capture d'image (101).

13. L'hôte (10) selon la revendication 5 comprenant également:

un circuit de charge (106) connecté électriquement au module d'alimentation (105) pour charger le module d'alimentation (105) avec une alimentation électrique externe (50).

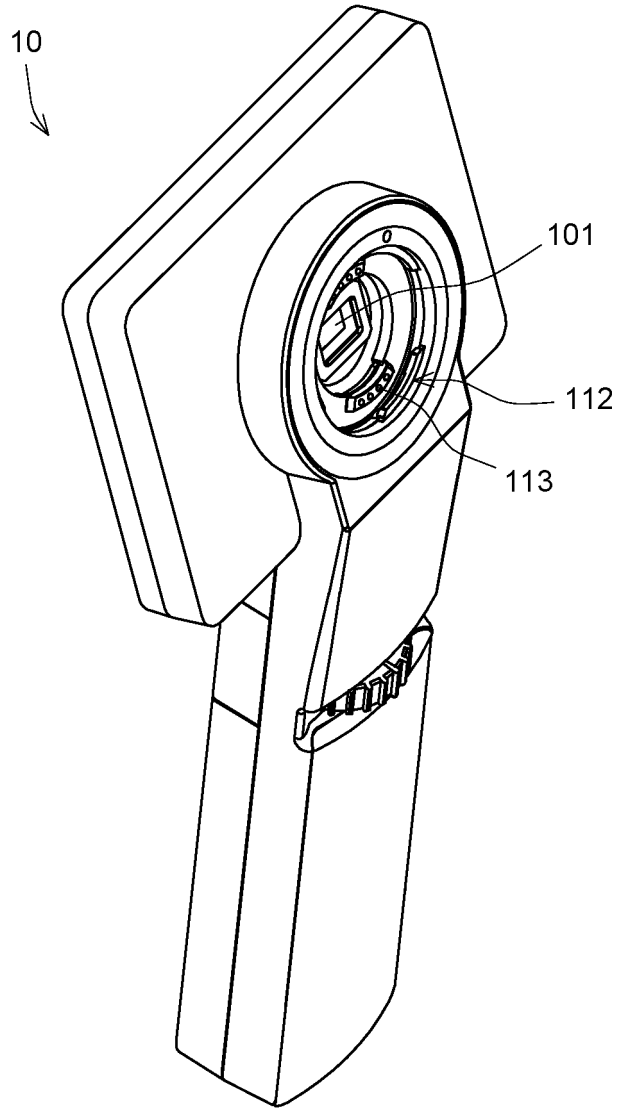

Fig. 1

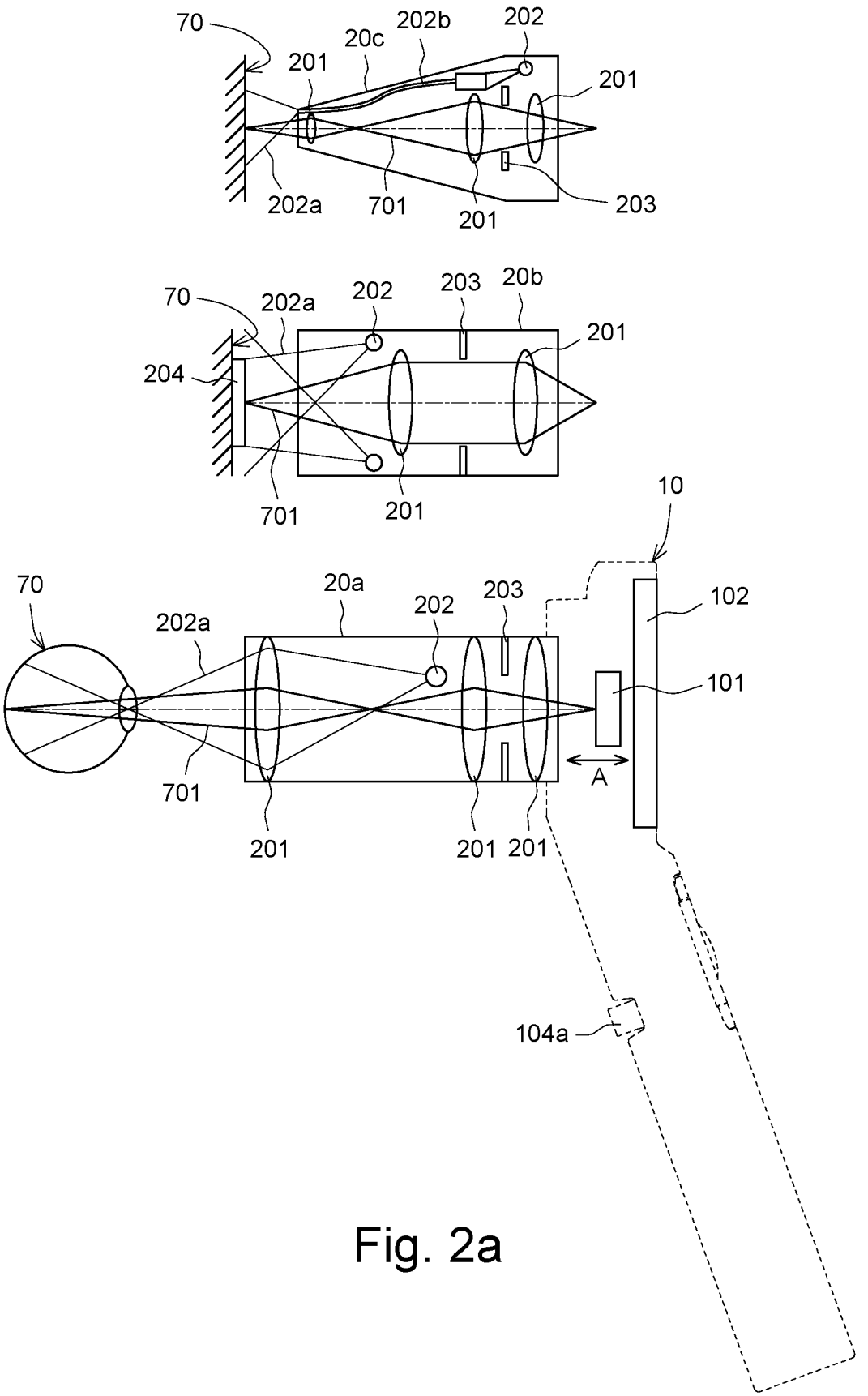
70
202b
202
20c
201
201
202a
701
201
203
70
202a
202
203
20b
201
204
701
201
10
70
20a
202
203
102
202a
101
A
701
201
201
201
104a

Fig. 2a

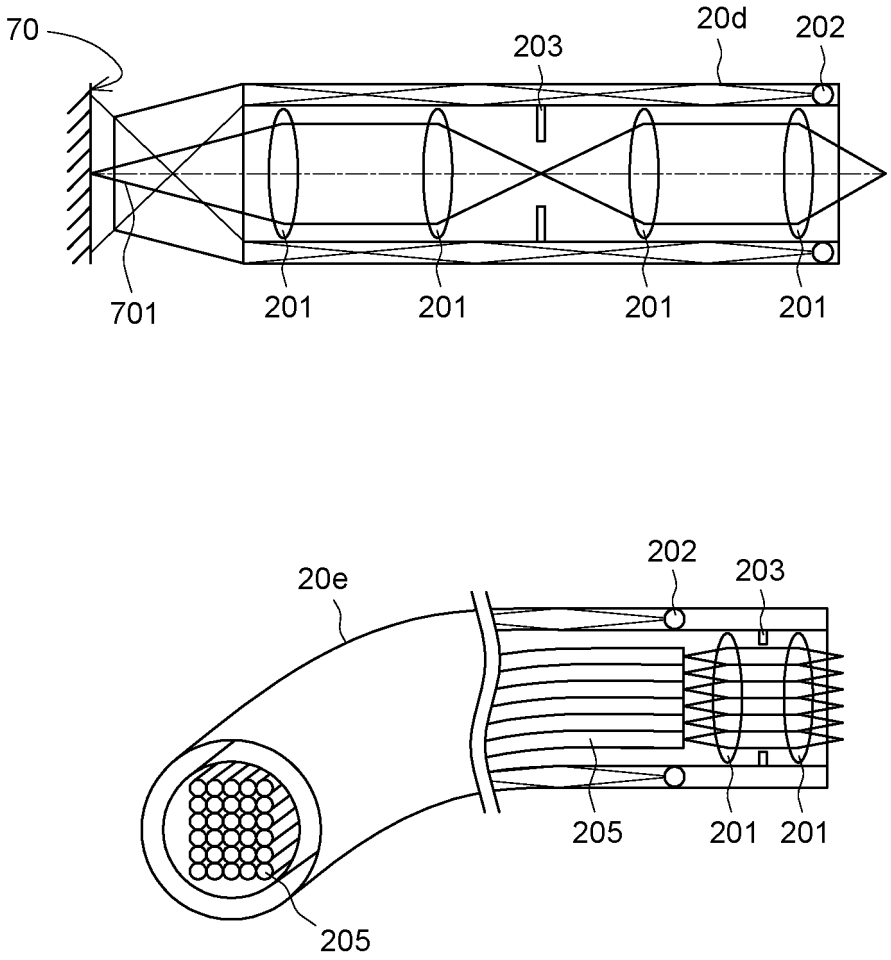

Fig. 2b

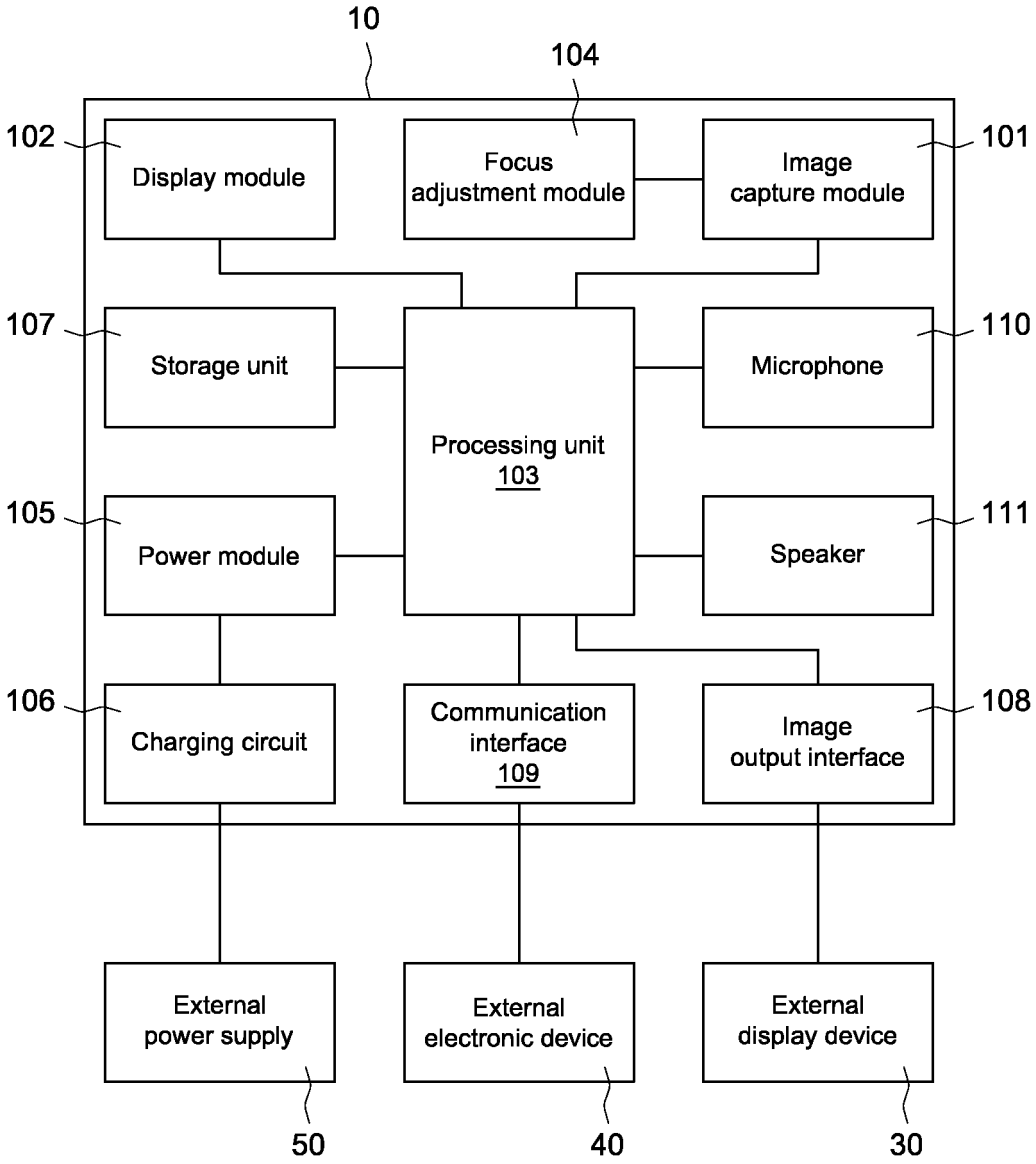
10
104
102
Display module
Focus adjustment module
Image capture module
101
107
Storage unit
Processing unit 103
Microphone
110
105
Power module
Speaker
111
106
Charging circuit
Communication interface 109
Image output interface
108
External power supply
External electronic device
External display device
50
40
30

Fig. 3

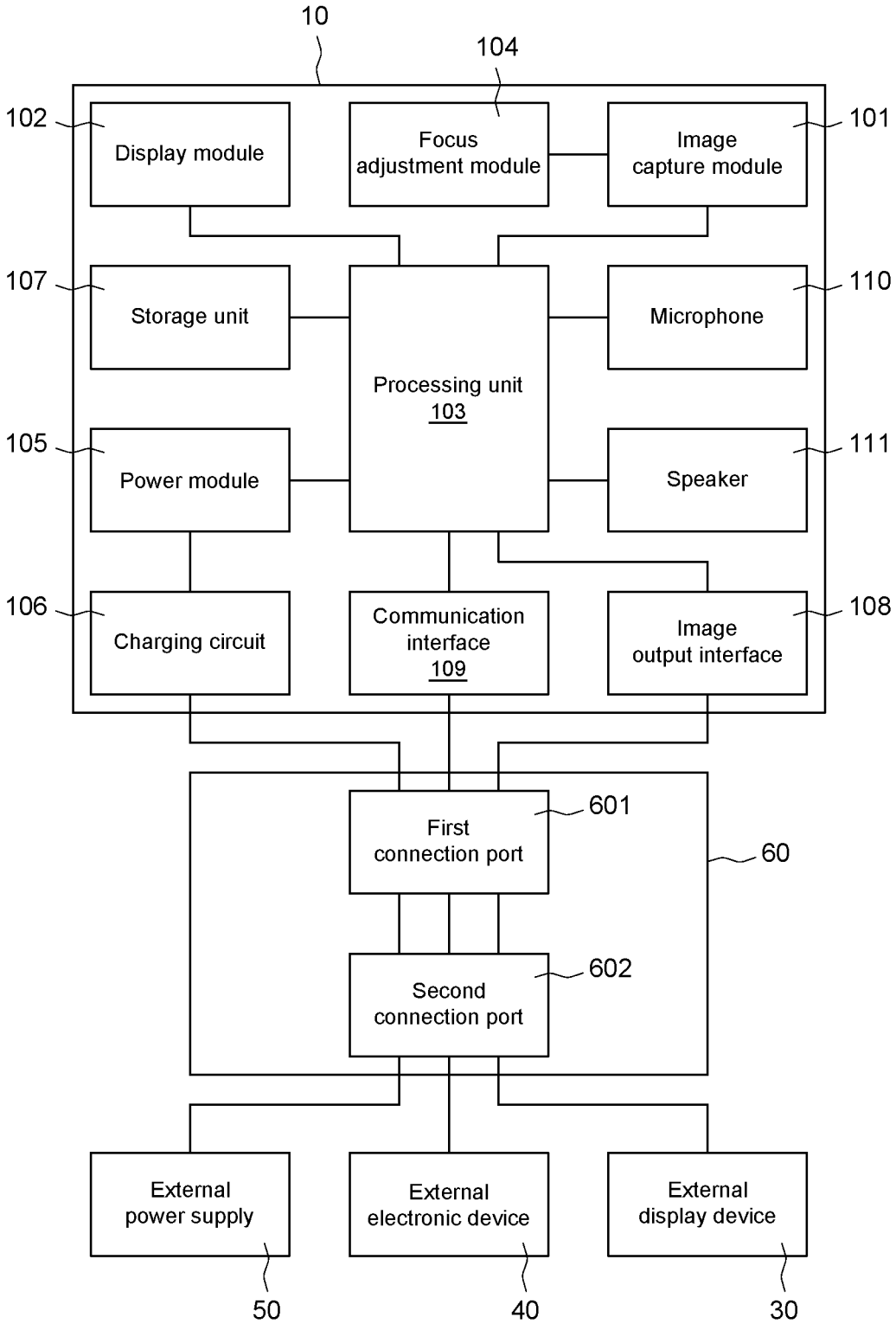
10
104
102
Display module
Focus adjustment module
Image capture module
101
107
Storage unit
Processing unit 103
Microphone
110
105
Power module
Speaker
111
106
Charging circuit
Communication interface 109
Image output interface
108
First connection port
601
60
Second connection port
602
External power supply
External electronic device
External display device
50
40
30

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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