US 20190038128A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2019/0038128 A1**

Purcell et al. (43) **Pub. Date: Feb. 7, 2019**

(54) **REMOTE BASED SYSTEM AND METHOD FOR COLLECTING EYE MOVEMENT DATA**

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(21) Appl. No.: **15/669,744**

(22) Filed: **Aug. 4, 2017**

Publication Classification

(51) **Int. Cl.**

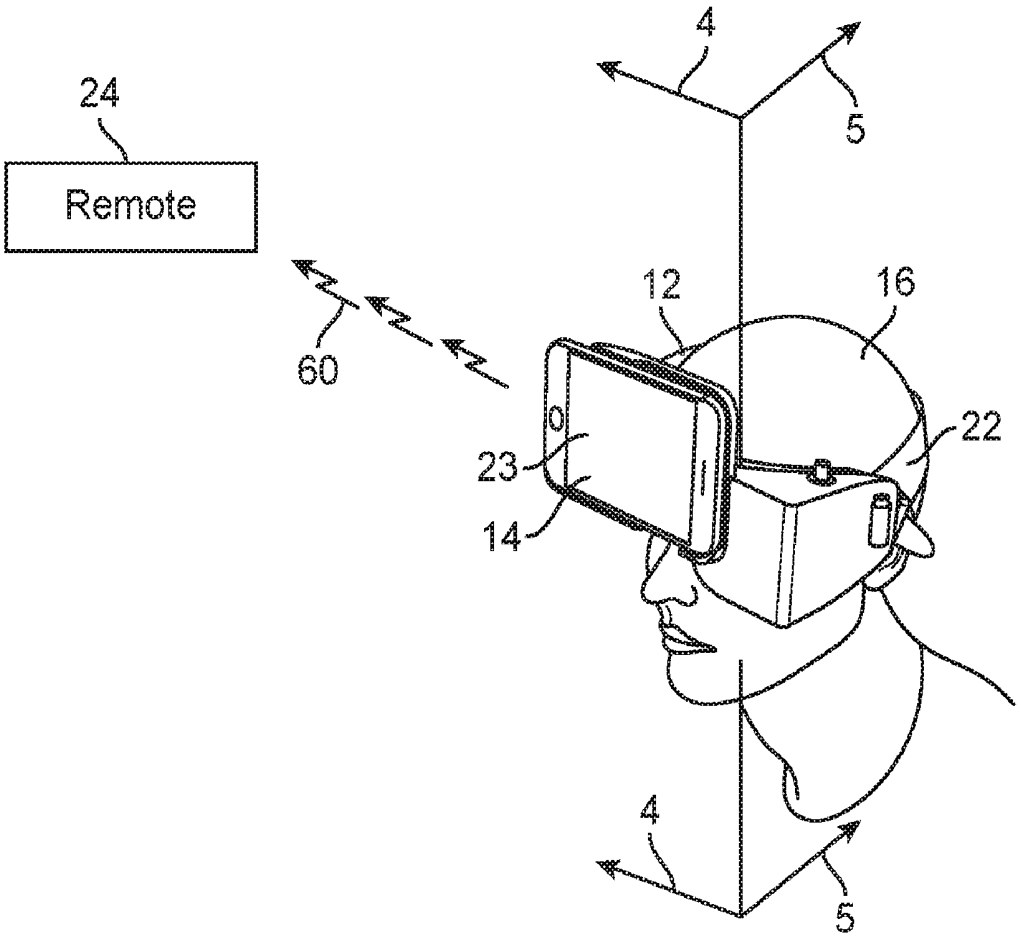
A61B 3/113	(2006.01)
G02B 27/01	(2006.01)
G06F 19/00	(2006.01)
A61B 5/00	(2006.01)

(52) **U.S. Cl.**

CPC ***A61B 3/113*** (2013.01); ***G02B 27/017*** (2013.01); *G02B 2027/014* (2013.01); ***A61B 5/0002*** (2013.01); ***G06F 19/3418*** (2013.01)

(57) **ABSTRACT**

A remote diagnostic system and method for collecting eye-movement data includes a mobile visual recording device which is mounted on a set of goggles. In this combination, the recording device will necessarily include both a camera and a computer. With the combined visual recording device and goggles stabilized on the head of a patient/user, a blackout vision chamber is established in front of an eye of the patient/user. An illuminator on the goggles can then be activated to illuminate the eye, and the camera in the visual recording device can record eye-movement data from the patient's eye while it is illuminated. A programmed protocol from the computer directs the patient using voice commands through a predetermined sequence of head orientations in space and collects eye-movement data that is used to generate a record of nystagmographs and gyroscopic head positions/stabilization data. The record of eye movements can then be automatically uploaded and viewed remotely by physicians via the web-based browser for diagnostic purposes.



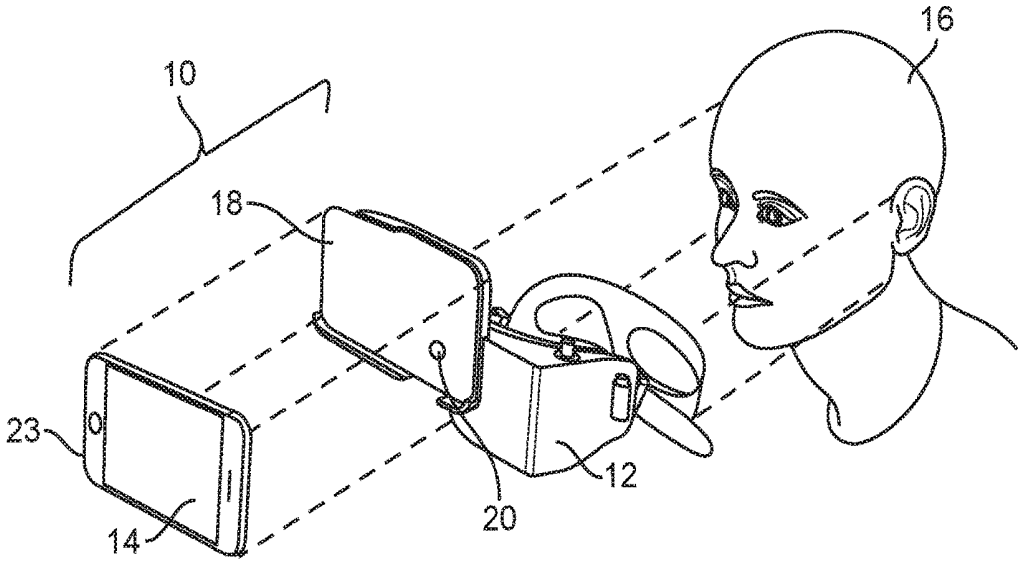


FIG. 1

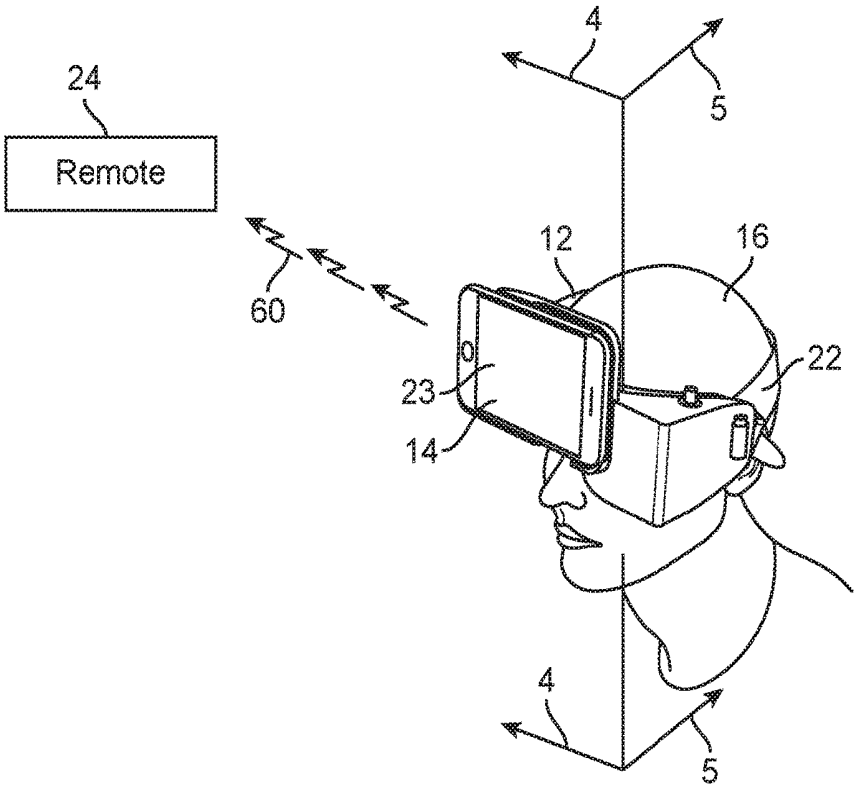


FIG. 2

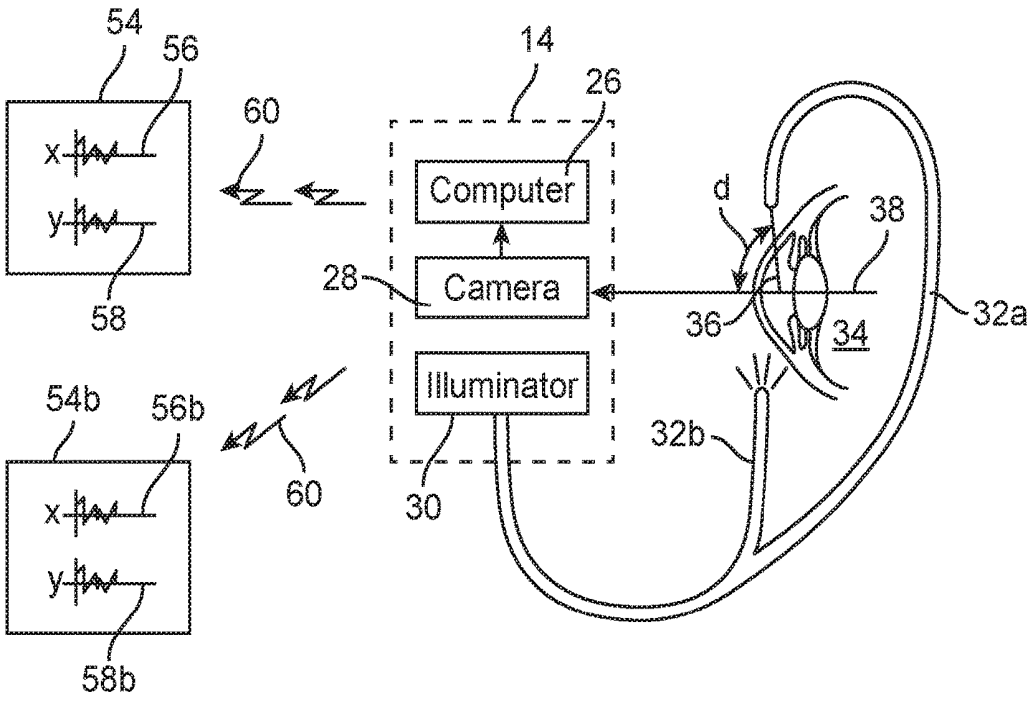

54
56
x
y
58
60
14
26
Computer
Camera
Illuminator
28
30
d
38
36
34
32a
32b
54b
56b
58b
60

FIG. 3A

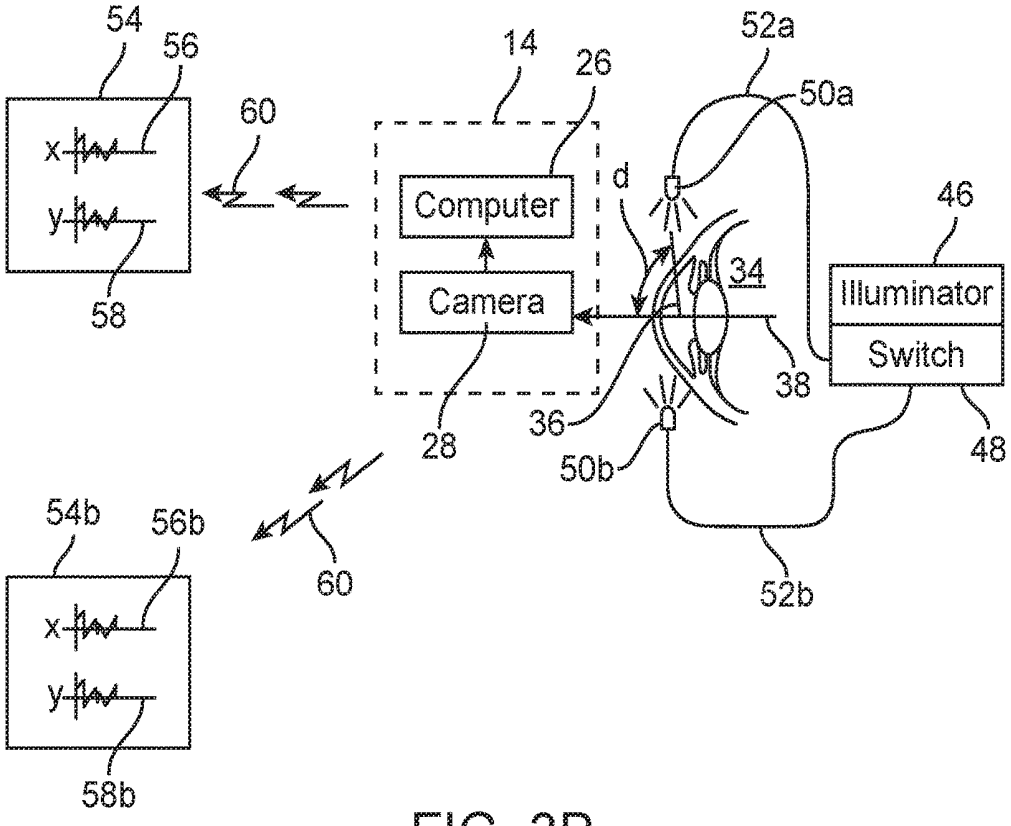

54
56
x
y
58
60
14
26
Computer
Camera
28
52a
50a
d
46
34
Illuminator
Switch
38
36
48
50b
52b
54b
56b
58b
60

FIG. 3B

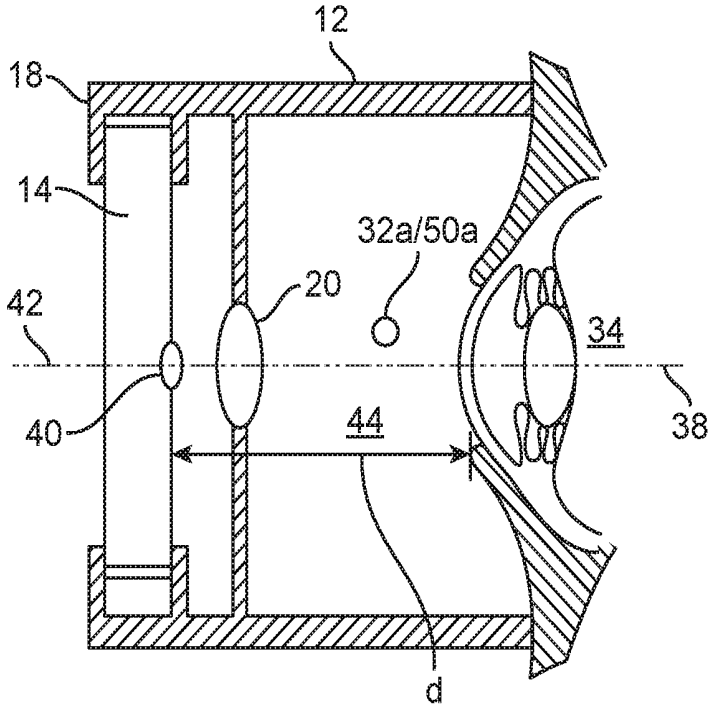


FIG. 4

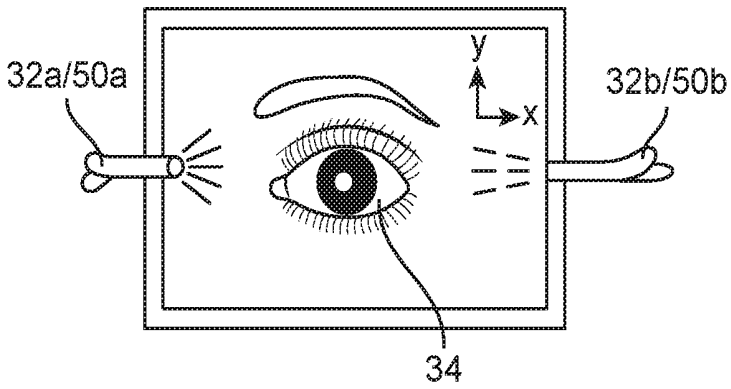


FIG. 5

REMOTE BASED SYSTEM AND METHOD FOR COLLECTING EYE MOVEMENT DATA

FIELD OF THE INVENTION

[0001] The present invention pertains to systems and methods for collecting eye-movement data. More particularly, the present invention pertains to systems and methods which can be used by a patient/user, on-demand when they are experiencing episodes of vertigo, to collect eye-movement data that can be transmitted to a remote location and presented in a web-based video player simultaneously with nystagmograph datagraphs for clinical evaluation by the patient's healthcare practitioner. The present invention is particularly, but not exclusively, useful for systems and methods which collect eye-movement data using a mobile visual recording device, such as a commercially available smart phone.

BACKGROUND OF THE INVENTION

[0002] Eye-movement data can provide very important diagnostic information for evaluating many different health conditions that may affect a person. For instance, it is known that eye-movement data is diagnostically pertinent for various physiological conditions, such as Benign Paroxysmal Positional Vertigo (BPPV), Migraine, Meniere's Disease, Viral Labyrinthitis, Intracranial Processes (i.e. tumors), and Cardiac Causes. As a practical matter, it typically happens that these conditions are manifested during so-called dizzy spells. Dizzy spells, of course, can happen anywhere and at any time in response to a variety of many different stimuli. Thus, it is desirable for a person who is subject to dizziness to have a diagnostic tool that is readily available, convenient, and easy to use for the purpose of helping identify his/her affliction. This capability, however, requires an ability to visually record eye-movement data during the dizzy spell or, alternatively, in accordance with a predetermined protocol.

[0003] These days, a well-known device for taking video pictures is a commercially available visual recording device of a type that is popularly referred to as a smart phone. With this in mind, it has been recognized by the present invention that such a device can be adapted for visually recording episodes of eye movements. Furthermore, it has been recognized that such a device can be configured with an "app" (i.e. computer program) which will format the episodes of eye movements for a proper clinical evaluation and diagnosis.

[0004] In light of the above, it is an object of the present invention to provide a system and method for collecting eye-movement data using a mobile visual recording device. Another object of the present invention is to provide systems and methods which can be used for a patient/user, on-demand, to collect eye-movement data for transmission to a remote location where both videos and nystagmographs are simultaneously displayed on a web-based browser for clinical evaluation. Still another object of the present invention is to provide a system and method for collecting eye-movement data which is relatively easy to manufacture, is operationally simple to use, and which is comparatively cost effective.

SUMMARY OF THE INVENTION

[0005] In overview, the present invention requires a headset (i.e. goggles) which is formed for adaptive engagement with a mobile visual recording device (e.g. a smart phone). Once the smart phone has been mounted on the goggles, the combination is then positioned and stabilized on the head of the patient/user. Next, the smart phone is activated to record the patient's eye movements during an episode of vertigo.

[0006] As envisioned for the present invention, eye movements can be recorded at any appropriate time, and at any location (e.g. at home, at work, or at a doctor's office). The recorded eye-movement data can then be used to prepare a report that will serve as a diagnostic tool for evaluating the condition of the patient/user. For purposes of the present invention, this report can be prepared using a pre-programmed computer application that is installed in (i.e. downloaded onto) the mobile visual recording device.

[0007] Structurally, the present invention includes a base member which is adapted to be held and stabilized on the head of a patient/user. Formed onto the base member is a bracket for holding a visual recording device. Importantly, the visual recording device will need to include both a camera, which defines a camera axis, and a computer. Further, the base member includes an adaptive lens which is used to focus the camera of the visual recording device onto an eye of the patient/user during an operation of the present invention.

[0008] With the combined base member and visual recording device positioned and stabilized on the head of a patient/user, a blackout vision chamber is established between the base member and an eye of the patient/user. An illuminator, which is mounted on the base member, is then activated. The purpose here is two-fold. For one, with the patient's eye positioned in the blackout vision chamber, and illuminated by the illuminator, the camera axis of the visual recording device can be aligned with an optical axis of the eye. For another, after an alignment of these axes is established and while the eye is illuminated, eye-movement data can be recorded by the visual recording device.

[0009] In detail, for one embodiment of the present invention, the illuminator includes a source of visible light which is incorporated as a component of the visual recording device. It also includes at least one optical fiber for directing visible light from the light source, to the base member and into the blackout vision chamber. For this embodiment of the present invention, the visible light from the light source is directed into the blackout vision chamber via the optical fiber onto a beam path that is oriented at an angle a, transverse to the optical axis of the eye. Preferably, the angle a will be in range between 45° and 90°, to thereby provide for a side-illumination of the patient's eye.

[0010] For another embodiment of the present invention, a visible light source may be provided on the base member. In this case, the light source will preferably by a Light Emitting Diode (LED) of a type well known in the art. With this embodiment a switch is provided on the base member for selectively turning the light source on/off. Like the embodiment where visible light is generated by a source on the visual recording device, for this alternate embodiment light will also be directed into the blackout vision chamber on a beam path that is oriented at an angle a transverse to the optical axis of the eye, to thereby provide a side-illumination of the patient's eye.

[0011] As indicated above, in an operation of the present invention, the visual recording device records an episode of eye-movement data, and then prepares a report based on this data. For purposes of the present invention, the report will

typically include a nystagmogram which records eye movements as a combination of horizontal (x-axis) and vertical (y-axis) measurements. In the nystagmogram, these measurements will correspond to respective deviations of the eye's optical axis from a base reference. Moreover, these deviations are measured simultaneously and they are presented on a same time line as the video of the eye movements. The visual recording device upon completion of the recording session instantaneously uploads the data set including the video eye movements and nystagmographs to a web based server where those data sets are made available for viewing by the patient or patient's physician anytime. As also indicated above, an evaluation of the resultant nystagmogram can provide valuable information regarding a patient's health condition.

[0012] In accordance with the present invention, its overall operation is established and controlled by a pre-programmed computer application (i.e. an "app") which can be downloaded onto the mobile visual recording device. In particular, the computer application will include executable instructions that include visual and voice commands for directing the computer of the visual recording device to perform a process for collecting eye-movement data. These executable verbal and graphic instructions will necessarily include:

[0013] verifying a stabilized placement of the base member on the head of a patient to establish a blackout vision chamber in front of an eye, between the base member and the eye of the patient, wherein the mobile visual recording device is mounted on the base member, wherein the camera of the mobile visual recording device defines a camera axis, and wherein the eye of the patient has a visual axis;

[0014] activating an illuminator, wherein the illuminator is mounted on the base member for directing visible light into the blackout vision chamber and onto the eye of the patient, and wherein the visible light is directed from the illuminator and into the blackout vision chamber along a beam path that is transverse to an optical axis of the eye, to thereby illuminate the eye during eye movement;

[0015] determining when the camera axis of the visual recording device is aligned with the optical axis of the eye, via an adaptive lens mounted on the base member, to focus the visual recording device onto the eye of the patient;

[0016] verbally instructing the patient through a predetermined sequence of head orientations in space;

[0017] initiating a "GO" signal when each proper head orientation is properly established to receive illuminated eye movement data for a predetermined period of time in each head position;

[0018] verbally instructing the patient to hold their head still and keep their eyes open in each of the predetermined head positions

[0019] recording illuminated eye-movement and gyroscopic head position data from the patient; and preparing a report based on the recorded eye-movement data that is displayed when both videos and nystagmographs are simultaneously displayed on a web-based browser for remote clinical evaluation

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The novel features of this invention, as well as the invention itself, both as to its structure and its operation, will be best understood from the accompanying drawings, taken in conjunction with the accompanying description, in which similar reference characters refer to similar parts, and in which:

[0021] FIG. **1** is an exploded perspective view of system components for the present invention, with the components shown in their operative relationship with the head of a patient/user;

[0022] FIG. **2** is a view of the present invention as seen in FIG. **1** with the system components combined and operatively stabilized on the head of a patient/user;

[0023] FIG. **3**A is a schematic presentation of the functional aspects for an embodiment of the present invention using an illuminator mounted in a visual recording device;

[0024] FIG. **3**B is a schematic presentation of the functional aspects for an alternate embodiment of the present invention using an illuminator mounted on the base member of the system;

[0025] FIG. **4** is a cross-section view of the system of the present invention as seen along the line **4-4** in FIG. **2**; and

[0026] FIG. **5** is a cross-section view of the system of the present invention as seen along the line **5-5** in FIG. **2**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0027] Referring initially to FIG. **1**, a system in accordance with the present invention is shown in an exploded perspective view and is generally designated **10**. As shown, the system **10** includes a base member **12** and a visual recording device **14** (hereinafter sometimes referred to simply as "device **14**"). With reference to both FIG. **1** and FIG. **2**, it will be appreciated that the system **10** is intended to be positioned on the head of a patient/user **16** (hereinafter sometimes referred to simply as "patient **16**"). Further, in FIG. **1**, it will be seen that the base member **12** is formed with a bracket **18**, and that it includes an adaptive lens **20**. In combination, the bracket **18** is provided to hold the device **14** on the base member **12** and to thereby have the combination function as a pair of goggles. As shown in FIG. **2**, the combination of device **14** and base member **12** (i.e. goggles) is to be held and stabilized on the head of the patient **16** by a strap **22**. Both FIG. **1** and FIG. **2** show that a gyroscope **23** is also mounted on base member **12** to provide information for determining the three-dimensional, spatial, orientation of the head of patient **16** at any point in time.

[0028] With reference to FIG. **2**, it is envisioned that the device **14** of system **10** for the present invention can be operationally connected in wireless communication with a remote **24**. For purposes of the present invention, the remote **24** may be a database, a clinical location, a medical facility, a person, or some other entity (all not shown) with which/whom the patient **16** desires to communicate. Additionally, or alternatively, along with transmissions to the remote **24**, the device **14** can maintain an internal file for any informational data that is obtained during an operation of the system **10**.

[0029] With reference now to FIG. **3**A it will be appreciated that the device **14** essentially includes a computer **26** and a camera **28**. Still referring to FIG. **3**A, it is also to be appreciated that the visual recording device **14** will incor-

porate an illuminator **30** which includes a source of visible light. For a preferred embodiment of the present invention, visible light from the illuminator **30** is to be transmitted over a pair of optical fibers **32***a* and **32***b*. In this combination, visible light from the illuminator **30** is directed via the optical fibers **32***a* and **32***b* toward an eye **34** of the patient **16**. In detail, this transmission is accomplished to direct visible light along a beam path **36** that is oriented at an angle a relative to an optical axis **38** of the eye **34**. For the present invention, the angle a is preferably in a range from 45° to 90°. The eye **34** is thus provided with side-illumination.

[0030] FIG. **4** shows the device **14** in combination with the base member **12** when they are operationally positioned in front of an eye **34** on the head of the patient **16**. Also, it will be seen in FIG. **4** that the camera **28** of device **14** includes a camera lens **40** which defines a camera axis **42**. Further, FIG. **4** shows that the adaptive lens **20** of base member **12** is positioned between the camera lens **40** and the eye **34** of the patient **16**. Importantly, when the combination of base member **12** and device **14** (i.e. goggles) is positioned on the head of the patient **16**, two functional requirements are achieved. For one, a blackout vision chamber **44** is created in front of the eye **34**. For another, the depth of field for camera **28** of the device **14** is shortened to a distance d. Specifically, this is done to accommodate for the reduced distance between the camera lens **40** and the eye **34**. Preferably, the distance d will be in a range between 1.5 cm and 3 cm.

[0031] An alternate embodiment of the system **10** for the present invention is shown in FIG. **3**B. For this alternate embodiment it is to be appreciated that an illuminator **46** can be mounted on the base member **12**, rather than on the visual recording device **14**. In this combination for the alternate embodiment, the illuminator **46** is activated by an on/off switch **48** which is connected to two different light sources **50***a* and **50***b* via respective connectors **52***a* and **52***b*. For purposes of the present invention the light sources **50***a* and **50***b* are preferably Light Emitting Diodes (LEDs) of a type well known in the art. Similar to the embodiment of system **10** shown in FIG. **3**A, FIG. **3**B shows that the light sources **50***a* and **50***b* direct visible light along the beam path **36** which is oriented at the angle a relative to the optical axis **38** of the eye **34**.

[0032] Prior to an operation of the system **10**, it is first necessary to establish and verify a properly stabilized position for the device **14** on the head of the patient **16**. As intended for the present invention, this will occur when the optical axis **38** of an eye **34** is aligned, and substantially collinear, with the camera axis **42** of camera **28**. This can all be done while monitoring camera **28** after the blackout vision chamber **44** has been established, and after the illuminator **30**/**46** has then been activated. As intended for the present invention, an operation of the system **10** will generate a report that will serve as a diagnostic tool for clinical personnel. In accordance with the present invention, this is accomplished while the eye **34** is side-illuminated as shown in FIG. **5**.

[0033] In further detail, an operation of the present invention provides the patient **16** with the ability for self-operation, without assistance. To do this, the combination of base member **12** (i.e. goggles) and the visual recording device **14** is positioned on the head of the patient as described above. The visual recording device **14** is then activated, and the illuminator **30**/**46** is turned on. Visual recording device **14** will then verbally instruct the patient **16** to move his/her head through a predetermined sequence of head positions (orientations).

[0034] These positions are:

[0035] Body supine with head turned to the right 30°;

[0036] Body sitting with head neutral;

[0037] Body supine with head turned to the left 30°; and

[0038] Body sitting with head neutral.

[0039] The Visual Recording Device **14** may also verbally instruct the patient **16** to move his/her head through another predetermined sequence of head positions (orientations).

[0040] These positions are:

[0041] Body supine and head elevated 30° off earth horizontal axis and head center;

[0042] Body supine and head elevated 30° off earth horizontal axis and head yaw 30° to the right;

[0043] Body supine and head elevated 30° off earth horizontal axis and head yaw 30° to the left.

[0044] In accordance with an operation of the present invention, each head position (orientation) in the predetermined sequence is verified by signals from the gyroscope **23**. In particular, this verification the predetermined sequence is verified by signals from the gyroscope **23**. In particular, this verification includes signals that indicate: whether the head of the patient **16** is properly positioned (oriented); and whether the proper head position (orientation) has been stabilized for the ten to fifteen second duration required to record eye movements. When verification is completed, the patient **16** will be verbally instructed to move his/her body and head to the next sequential head position (orientation). Once the sequence of eye movement data has been recorded by the visual recording device **14**, the data can be transmitted via a wireless link **60** to the remote **24** where it can be viewed by the patient or patient's physician at a later date.

[0045] During an eye movement episode at each head orientation, both x and y measurements are simultaneously taken. As shown in FIGS. **3**A and **3**B, the result of these measurements is a nystagmogram **54** which presents x-measurements **56** on a same time reference with the y-measurements **58** of eye **34**. Also during an eye movement episode at each head orientation, both x and y measurements representing head stability are simultaneously collected. As shown in FIGS. **3**A and **3**B the result of these measurements is a graph **54***b* which presents x measurements **56***b* on a same time reference with the y measurements **58***b* of the patient/user head **16**. While the particular Remote-Based System and Method for Collecting Eye-Movement and Head Stability Data as herein shown and disclosed in detail is fully capable of obtaining the objects and providing the advantage herein before stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as described in the appended claims.

Glossary—File #11665.1

[0046] **10** system

[0047] **12** base member

[0048] **14** visual recording device (eg. Smartphone)

[0049] **16** patient/user

[0050] **18** bracket

[0051] **20** adaptive lens

[0052] **22** strap

[0053] **23** gyroscope

[0054] **24** remote
[0055] **26** computer
[0056] **28** camera
[0057] **30** illuminator
[0058] **32** optical fibers (a, b)
[0059] **34** eye
[0060] **36** beam path
[0061] **38** optical axis
[0062] **40** camera lens
[0063] **42** camera axis
[0064] **44** blackout vision chamber
[0065] **46** illuminator
[0066] **48** on/off switch
[0067] **50** light sources (a, b)
[0068] **52** connectors (a, b)
[0069] **54** nystagmogram
[0070] **54***b* graphical head stability data
[0071] **56** x-measurements
[0072] **56***b* x-measurements head stability
[0073] **58** y-measurements
[0074] **58***b* y-measurements head stability
[0075] **60** wireless or internet connection
[0076] **62**
[0077] **64**
[0078] **66**
[0079] **68**
[0080] **70**
[0081] **72**
[0082] **74**
[0083] **76**
[0084] **78**
[0085] **80**
[0086] **82**
[0087] **84**

What is claimed is:

1. A system for collecting eye-movement data using a mobile visual recording device, wherein the mobile visual recording device includes a camera defining a camera axis, the system compromising:

a base member adapted to be held and stabilized on the head of a patient to establish a blackout vision chamber between the base member and an eye of the patient;

a bracket formed on the base member for holding the visual recording device on the base member;

an adaptive lens mounted on the base membrane for focusing the visual recording device onto the eye of the patient;

an illuminator for directing visible light into the blackout vision chamber and onto the eye of the patient along a beam path transverse to an optical axis of the eye, to illuminate the eye during eye movement; and

a pre-programmed computer application installed in the mobile visual recording device for verbally and graphically directing the patient through a predetermined sequence of head orientations, for receiving illuminated eye-movement and gyroscopic position and head stability data from the patient, and for processing the eye movement and head position/stability data to prepare a report based on the eye-movement and head position/stability data.

2. The system of claim **1** further compromising a gyroscope mounted on the base member for providing head orientation and head stability data to the computer application during the predetermined sequence of head orientations.

3. The system of claim **2** further compromising an audio means mounted on the mobile visual recording device, wherein the audio means is responsive to head orientation data from the computer application for verbally instructing the patient into a correct head orientation during the predetermined sequence of head orientations, and for verifying a proper assumption of the correct head orientation.

4. The system of claim **1** wherein the illuminator comprises:

a light source mounted on the base member; and

an on/off switch mounted on the base member for activating the light source.

5. The system of claim **1** wherein the illuminator comprises:

a light source mounted on the mobile visual recording device for generating visible light; and

at least one optical fiber interconnecting the light source with the blackout vision chamber to provide a side-illumination of the eye.

6. The system of claim **1** wherein the camera axis of the mobile visual recording device is aligned with the optical axis of the eye via the adaptive lens when the mobile visual recording device is engaged with the base member and the base member is held on the head of the patient, wherein the adaptive lens establishes a depth of field d for the mobile visual recording device, and wherein d is in range between 1.5 cm and 3 cm (1.5 cm<d<3 cm).

7. The system of claim **5** wherein an angle a between the beam path and the optical axis of the eye is in a range between 45° and 90° (45°<a<90°).

8. The system of claim **7** wherein the report includes a nystagmogram and a graphical representation of head position/stability data.

9. The system of claim **7** wherein the system is remote-based and the report is transmitted from the visual recording device to a clinical specialist via a web-based browser and video player.

10. The system of claim **1** wherein the mobile recording device is a smart phone and the base member is a pair of goggles with a head strap.

11. A method for collecting eye movement and head position/stability data in real time, using a mobile visual recording device, the system compromising the steps of:

providing a base member, wherein the base member includes a bracket formed thereon for holding a visual recording device, and wherein the bracket is formed with an adaptive lens;

Positioning the visual recording device on the bracket of the base member, wherein the visual recording device includes a camera defining a camera axis;

stabilizing the base member on the head of a patient to establish a blackout vision chamber between the base member and an eye of the patient;

aligning the camera axis of the visual recording device with an optical axis of the eye, via the adaptive lens mounted on the base member, to focus the visual recording device onto the eye of the patient;

activating an illuminator to direct visible light into the blackout vision chamber and onto the eye of the patient along a beam path transverse to an optical axis of the eye, to illuminate the eye during eye movement; and

using a pre-programmed computer application installed in the mobile visual recording device for verbally directing the patient through a predetermined sequence of

head orientations, for receiving illuminated eye-movement and head position/stability data from the patient at the head orientation, and for processing the eye-movement and head position/stability data to prepare a report, wherein the report includes a nystagmogram and a graphical representation of head position/stability data.

12. The method recited in claim **11** wherein the predetermined sequence of movements into head orientation includes assuming a position with:

Body supine with head turned to the right 30°;

Body sitting with head neutral;

Body supine with head turned to the left 30°; and

Body sitting with head neutral;

or

Body supine and head elevated 30° off earth horizontal axis and head center;

Body supine and head elevated 30° off earth horizontal axis and head yaw 30° to the right;

Body supine and head elevated 30° off earth horizontal axis and head yaw 30° to the left and further wherein the head is held stationary in each head orientation for ten to fifteen seconds.

13. The method recited in claim **11** wherein the adaptive lens establishes a depth of field d for the mobile visual recording device, and wherein d is in a range between 1.5 cm and 3 cm (1.5 cm<d<3 cm).

14. The method recited in claim **11** further comprising the steps of:

generating visible light; and

directing the visible light into the blackout vision chamber to provide a side-illumination of the eye, and wherein an angle a between the beam path and the optical axis of the eye is in range between 45° and 90° (45°<a<90°).

15. The method recited in claim **11** wherein the method is useful for recording eye-movement data pertinent to an eye condition selected from the group of diagnostic options consisting of Benign Paroxysmal Positional vertigo (BPPV), Migraine, Meniere's Disease, Viral Labyrinthitis, Intracranial Processes (i.e. tumors), and Cardiac Causes, and further wherein the report includes a nystagmogram and head position/stability data, wherein the report is transmitted from the visual recording device to a clinical specialist, at a remote location, for at least one diagnostic option listed for selection from the group by the patient/user's physician, and further wherein the mobile recording device is a smart phone.

16. A non-transitory, computer-readable medium installed onto a computer in a mobile visual recording device, wherein the device includes a camera connected to the computer, and wherein the medium is a pre-programmed computer application having executable instructions stored thereon that direct the computer to perform a process for collecting eye-movement and head position/stability data, the medium comprising instructions for:

verifying a stabilized placement of a base member on the head of a patient to establish a blackout vision chamber between the base member and an eye of the patient, wherein the mobile visual recording device is mounted on the base member, wherein the camera of the mobile visual recording device defines a camera axis, and wherein the eye of the patient has a visual axis;

activating an illuminator to direct visible light into the blackout vision chamber and onto the eye of the patient, and wherein the visible light is directed from the illuminator and into the blackout vision chamber along a beam path transverse to an optical axis of the eye, to illuminate the eye during eye movement;

determining when the camera axis of the visual recording device is aligned with the optical axis of the eye, via an adaptive lens mounted on the base member, to focus the visual recording device onto the eye of the patient;

directing the patient through a predetermined sequence of head orientations;

initiating an audible verbal "GO" signal for each head orientation, when the head orientation has been properly established;

receiving illuminated eye movement and head position/stability data from the patient at each head orientation; and

processing the eye-movement and head position/stability data during the receiving step to prepare a report based on the received eye movement and head position/stability data, wherein the report includes a nystagmogram and graphical representation of the patients' head position/stability data.

17. The medium of claim **16** further comprising an instruction for transmitting the report from the visual recording device to a clinical specialist, at a remote location, and wherein the visual recording device is a smart phone.

18. The medium of claim **16** wherein the adaptive lens establishes a depth of field d for the mobile visual recording device, and wherein d is in a range between 1.5 cm and 3 cm (1.5 cm<d<3 cm).

19. The medium of claim **16** wherein the illuminator comprises:

a light source mounted on the mobile visual recording device for generating visible light; and

at least one optical fiber interconnecting the light source with the blackout vision chamber to provide a side-illumination of the eye, and wherein an angle a between the beam path and the optical axis of the eye is in a range between 45° and 90° (45°<a 90°).

20. The medium of claim **16** wherein the medium is useful for recording eye-movement data pertinent to an eye condition selected form the group of diagnostic options consisting of Benign Paroxysmal Positional Vertigo (BPPV), Migraine, Meniere's Disease, Viral Labyrinthitis, Intracranial Processes (i.e. tumors), and Cardiac Causes.

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专利名称(译)	基于远程的眼动数据采集系统及方法		
公开(公告)号	US20190038128A1	公开(公告)日	2019-02-07
申请号	US15/669744	申请日	2017-08-04
[标]申请(专利权)人(译)	PURCELL IAN 曲银虹		
申请(专利权)人(译)	PURCELL，IAN 曲，银虹		
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IPC分类号	A61B3/113 G02B27/01 G06F19/00 A61B5/00		
CPC分类号	A61B3/113 G02B27/017 G06F19/3418 A61B5/0002 G02B2027/014 A61B5/1128 A61B5/4023 A61B5/4863 A61B5/6803 A61B5/6898 G02B27/0093 G16H40/63 G16H40/67		
外部链接	Espacenet USPTO		

摘要(译)

用于收集眼球运动数据的远程诊断系统和方法包括安装在一组护目镜上的移动视觉记录装置。在这种组合中，记录设备必须包括照相机和计算机。通过将组合的视觉记录装置和护目镜稳定在患者/用户的头部上，在患者/用户的眼睛前方建立遮光视觉室。然后可以激活护目镜上的照明器以照亮眼睛，并且视觉记录设备中的摄像机可以在患者的眼睛被照亮时记录眼睛运动数据。来自计算机的编程协议使用语音命令通过空间中的预定头部方向序列引导患者，并收集眼睛运动数据，该眼睛运动数据用于生成眼球震颤仪和陀螺仪头部位置/稳定数据的记录。然后，医生可以通过基于网络的浏览器远程上传和远程观察眼球运动记录以进行诊断。