

VISUAL ACUITY ASSESSMENT SYSTEM AND METHOD

FIELD OF INVENTION

The present invention broadly relates to a visual acuity assessment system and method.

BACKGROUND

Various visual acuity assessment systems and methods have been developed to identify and possibly rectify problems related to visual acuity. In a typical visual acuity measurement, a subject (patient) is positioned at a fixed distance, e.g. 6 metres (m), from a display with one eye open and the other eye preferably completely covered. An optometrist then shows an eye test chart comprising a series of characters or numbers, called optotypes, of decreasing sizes to the subject who attempts to correctly identify the optotype being shown using only the open (first) eye. The visual acuity of the eye under test is a quantitative measure of the ability to see an in-focus image at a certain, standardized distance and may be determined e.g. based on the smallest size of the optotypes that are correctly identified by said eye. The test may be repeated for the other (second) eye, which can have a difference visual acuity from the first eye.

One problem with the conventional visual acuity measurement systems and methods is that they usually require a trained optometrist. Thus, a patient who requires regular measurement cannot perform self-assessment without visiting an eye lab. In addition, the conventional methods are somewhat manual and may thus be prone to inaccuracy due to e.g. the patient's difficulty in communicating with the optometrist, or partial coverage of the eye not being tested. Also, some of the conventional eye test charts are fixed displays. Thus, it is possible that a patient may have observed the chart at a larger size and memorised the optotypes before the test, thereby giving an inaccurate test result.

Several prior art approaches that seek to provide visual acuity assessment with varying degrees of automation have been disclosed. For example, US Patent No. 4869589 and 6406147 disclose systems having a hood or window which a test subject looks into, a display and an interface means for inputting the subject's response. The need to communicate with an optometrist may therefore be eliminated. However, these systems are somewhat bulky (i.e. not portable) and more suitable for a conventional lab or clinic.

US Patent No. 7367675 and 6386707 disclose system and method for vision testing which can be conducted remotely, e.g. over the Internet using a standard home computer. However, these methods are still somewhat manual in the sense that the subject needs to be prompted, e.g. to change the test from the left eye to the right eye.

A need therefore exists to provide a visual acuity assessment system and method that seeks to address at least one of the above problems, or at least to provide an alternative.

SUMMARY

In accordance with a first aspect of the present invention, there is provided a visual acuity assessment system comprising:

- a display configured to display an element of an eye test chart;
- a computing device coupled to the display for controlling at least a size and orientation of the element of the eye test chart; and
- an eye occluder coupled to the computing device,

wherein the computing device controls the eye occluder for selectively occluding an eye of a test subject, and

wherein the eye occluder comprises two substantially opaque movable flap members disposed between left and right eyes of a test subject and the display respectively and further comprises two perforated movable flap members disposed between the left and right eyes of a test subject and the two opaque movable flap members respectively.

The system may further comprise an input device coupled to the computing device for inputting the test subject's response to the element being displayed.

The input device may comprise one of a group consisting of a joystick, a keyboard, a touch pad, a mouse, a microphone, a tracker ball and a head tracker.

The computing device may control the size of the element of the eye test chart based on the test subject's response.

The computing device may control the display to display an element of a smaller size if a first threshold is reached based on the test subject's response.

The eye occluder may comprise:

actuating means coupled to each of the opaque movable flap members for actuating an opening or closing of the respective opaque movable flap members.

An actuation of the left opaque flap member may be independent from that of the right opaque flap member.

The eye occluder may further comprise actuating means coupled to each of the perforated movable flap members for actuating an opening or closing of the respective perforated movable flap members.

An actuation of the left perforated flap member may be independent from that of the right perforated flap member.

An actuation of the perforated flap member disposed on one side may be independent from that of the opaque flap member disposed on the same side.

The actuating means may comprise an electric motor.

The eye occluder may further comprise a circuit board comprising:
a microcontroller for controlling the actuating means and/or processing signals received from the computing device, and
a communication interface for communicating with the computing device.

In an initial assessment, the computing device may record the smallest element size correctly identified by one eye of the test subject, and control the respective perforated movable flap member to cover said eye for a continued assessment starting from said smallest element size. .

In accordance with a second aspect of the present invention, there is provided a visual acuity assessment method, the method comprising the steps of:
providing a display configured to display an element of an eye test chart;
providing a computing device coupled to the display for controlling at least a size and orientation of the element of the eye test chart;
providing an eye occluder coupled to the computing device; and
controlling the eye occluder using the computing device for selectively occluding an eye of a test subject, and

wherein the eye occluder comprises two substantially opaque movable flap members disposed between left and right eyes of a test subject and the display respectively, and further comprises two perforated movable flap members disposed between the left and right eyes of a test subject and the two opaque movable flap members respectively.

The method may further comprise providing an input device coupled to the computing device for inputting the test subject's response to the element being displayed.

The input device may comprise one of a group consisting of a joystick, a keyboard, a touch pad, a mouse, a microphone, a tracker ball and a head tracker.

The computing device may control the size of the element of the eye test chart based on the test subject's response.

The computing device may control the display to display an element of a smaller size if a first threshold is reached based on the test subject's response.

The eye occluder may comprise:

actuating means coupled to each of the opaque movable flap members for actuating an opening or closing of the respective opaque movable flap members.

An actuation of the left opaque flap member may be independent from that of the right opaque flap member.

The eye occluder may further comprise actuating means coupled to each of the perforated movable flap members for actuating an opening or closing of the respective perforated movable flap members.

An actuation of the left perforated flap member may be independent from that of the right perforated flap member.

An actuation of the perforated flap member disposed on one side may be independent from that of the opaque flap member disposed on the same side.

The actuating means may comprise an electric motor.

The eye occluder may further comprise a circuit board comprising:

- a microcontroller for controlling the actuating means and/or processing signals received from the computing device, and

- a communication interface for communicating with the computing device.

In an initial assessment, the computing device may record the smallest element size correctly identified by one eye of the test subject, and control the respective perforated movable flap member to cover said eye for a continued assessment starting from said smallest element size.

The computing device may control the eye occluder based on the steps of:
closing both flap members on a first side while keeping both flap members on a second side open during the initial assessment;
closing a perforated flap member on the second side while keeping both flap members on the first side closed and an opaque flap member on the second side open during the continued assessment.

The method may be repeated for the other eye of the test subject.

The method may further comprise storing results of the visual acuity assessment in a database.

In accordance with a third aspect of the present invention, there is provided a computer storage medium having stored thereon computer code means for instructing a computing device to execute a visual acuity assessment method, the method comprising the steps of:

- providing a display configured to display an element of an eye test chart;
- providing the computing device coupled to the display for controlling at least a size and orientation of the element of the eye test chart;
- providing an eye occluder coupled to the computing device; and
- controlling the eye occluder using the computing device for selectively occluding an eye of a test subject, and

wherein the eye occluder comprises two substantially opaque movable flap members disposed between left and right eyes of a test subject and the display respectively, and further comprises two perforated movable flap members disposed between the left and right eyes of a test subject and the two opaque movable flap members respectively.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

Figure 1 shows a schematic diagram of a visual acuity assessment system according to an example embodiment.

Figure 2A shows a perspective view of an eye occluder with eye flaps in a closed position according an example embodiment.

Figures 2B-2D show front, plan and side views of the eye occluder of Figure 2A respectively.

Figure 3A shows a perspective view of the eye occluder with eye flaps in an open position according an example embodiment.

Figures 3B-3D show front, plan and side views of the eye occluder of Figure 3A respectively.

Figure 4 shows a perspective view of a compartment of a first frame member of the eye occluder according to an example embodiment.

Figure 5 shows a partial perspective view of a second frame member of the eye occluder according to an example embodiment.

Figure 6 shows an image illustrating a simulated implementation of a visual acuity assessment system according to an example embodiment.

Figure 7 shows a flow chart illustrating a method for controlling the eye occluder according to an example embodiment.

Figure 8 shows a schematic diagram of a computer system for implementing a visual acuity assessment system and method according to an example embodiment.

Figure 9 shows a flow chart illustrating a visual acuity assessment method according to an example embodiment.

DETAILED DESCRIPTION

Figure 1 shows a schematic diagram of a visual acuity assessment system 100 according to an example embodiment. The visual acuity assessment system

100 comprises a computing device 104 coupled to each of a display 102, an eye occluder 106 and an input device 110.

The display 102 in the example embodiment is a graphic display of the computing device 104, e.g. a Liquid Crystal Display (LCD), or a Cathode Ray Tube (CRT) screen. Alternatively, the display 102 can be other types of display whose running sequence is controlled by the computing device 104. The display 102 is capable of displaying symbols 108 from an eye test chart, e.g. the Landolt-C eye test chart. It will be appreciated by a person skilled in the art that parameters such as brightness of the display 102 and size of the symbols are calibrated prior to use so as to be consistent with standard testing conditions.

In the example embodiment, the eye occluder 106 takes the form of an eyewear that can be worn by a test subject (not shown). The eye occluder 106 may be in a wired or wireless communication with the computing device 104 such that the computing device 104 can control which eye of the test subject to be occluded at a particular time of the test (to be discussed in detail below).

Also, in the system 100 of the example embodiment, the test subject enters his responses to the test through the input device 110, which communicates with the computing device 104 via e.g. a Universal Serial Bus (USB) connection. For example, here a joystick is used as the input device 110 such that the tilt direction of the joystick substantially corresponds to the orientation of the gap of the Landolt-C optotype that is being shown. It will be appreciated that other types of input device 110, including but not limited to a keyboard, a touch pad, a mouse, a tracker ball, a head tracker or a microphone, can also be used in alternate embodiments depending on e.g. the type of eye test chart.

Some portions of the description which follows are explicitly or implicitly presented in terms of algorithms and functional or symbolic representations of operations on data within a computer memory. These algorithmic descriptions and functional or symbolic representations are the means used by those skilled in the data processing arts to convey most effectively the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence

of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities, such as electrical, magnetic or optical signals capable of being stored, transferred, combined, compared, and otherwise manipulated.

Unless specifically stated otherwise, and as apparent from the following, it will be appreciated that throughout the present specification, discussions utilizing terms such as "scanning", "calculating", "determining", "measuring", "replacing", "generating", "initializing", "outputting", or the like, refer to the action and processes of a computer system, or similar electronic device, that manipulates and transforms data represented as physical quantities within the computer system into other data similarly represented as physical quantities within the computer system or other information storage, transmission or display devices.

The present specification also discloses apparatus for performing the operations of the methods. Such apparatus may be specially constructed for the required purposes, or may comprise a general purpose computer or other device selectively activated or reconfigured by a computer program stored in the computer. The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose machines may be used with programs in accordance with the teachings herein. Alternatively, the construction of more specialized apparatus to perform the required method steps may be appropriate. The structure of a conventional general purpose computer will appear from the description below.

In addition, the present specification also implicitly discloses a computer program, in that it would be apparent to the person skilled in the art that the individual steps of the method described herein may be put into effect by computer code. The computer program is not intended to be limited to any particular programming language and implementation thereof. It will be appreciated that a variety of programming languages and coding thereof may be used to implement the teachings of the disclosure contained herein. Moreover, the computer program is not intended to be limited to any particular control flow. There are many other variants of the computer program, which can use different control flows without departing from the spirit or scope of the invention.

Furthermore, one or more of the steps of the computer program may be performed in parallel rather than sequentially. Such a computer program may be stored on any computer readable medium. The computer readable medium may include storage devices such as magnetic or optical disks, memory chips, or other storage devices suitable for interfacing with a general purpose computer. The computer readable medium may also include a hard-wired medium such as exemplified in the Internet system, or wireless medium such as exemplified in the GSM mobile telephone system. The computer program when loaded and executed on such a general-purpose computer effectively results in an apparatus that implements the steps of the preferred method.

Referring to Figures 2-5, the eye occluder 106 (Figure 1) is now described in detail. Figure 2A shows a perspective view of an eye occluder with eye flaps in a closed position according an example embodiment. Figures 2B-2D show front, plan and side views of the eye occluder of Figure 2A respectively.

As mentioned above, the eye occluder 106 in the example embodiment takes the form of an eyewear and comprises a first frame member 202, a second frame member 204, a support member 208 and a pair of ear handles 210a, 210b. The eye occluder 106 is substantially symmetrical about a plane through a middle section of the support member 208. The first frame member 202 is detachably mounted to the second frame member 204 in the example embodiment by way of e.g. a snap-fit and/or a press-fit. The first and second frame members 202, 204 are substantially rigid and together define openings where eye flaps corresponding to left and right eyes of a test subject can be disposed.

Similar to a typical eyewear, the support member 208 is disposed between the openings and rests above the test subject's nose. The ear handles 210a, 210a are pivotally coupled to the second frame member 204 via hinges 212a, 212b respectively and rest above the test subject's ears. The ear handles 210a, 210b can be folded inward when the eye occluder 106 is not used, e.g. to minimize storage space.

As can be seen from Figures 2A-2D, solid (i.e. substantially opaque) flaps 206a, 206b are rotatably mounted to the openings such that, in the closed position,

the solid flaps 206a, 206b are substantially parallel with a front surface 214 of the first frame member 202, thereby substantially covering the openings. Also, as can be seen in Figure 2C, the first frame member 202 in the example embodiment comprises compartments disposed on either side (i.e. adjacent to the test subject's temples) for housing actuating means for rotating the flaps 206a, 206b (to be discussed in detail below).

In the example embodiment, the first and second frame members 202, 204, the solid flaps 206a, 206b, the support member 208 and the ear handles 210a, 210b are made from a plastic material, preferably of a medical grade to avoid or minimize irritation and/or allergic reactions to the test subject, via e.g. an injection moulding process.

Figure 3A shows a perspective view of the eye occluder 106 (Figure 1) with eye flaps in an open position according an example embodiment. Figures 3B-3D show front, plan and side views of the eye occluder of Figure 3A respectively.

In the open position, the solid flaps 206a, 206b are independently rotated outwardly with respect to the first frame member 202 such that one or both openings are not covered. In addition to the parts described above with respect to Figures 2A-2D, as can be seen from Figures 3A-3C, the eye occluder 106 further comprises pin-hole flaps 302a, 302b rotatably mounted to the first frame member 202, and eye-pieces 304a, 304b fixedly mounted to the second frame member 204. As appreciated by a person skilled in the art, the pin-hole flaps 302a, 302b each comprises a perforated pattern of small through holes disposed on a solid material, e.g. plastic. The size and density of the holes are understood by a person skilled in the relevant art, and therefore are not discussed herein. The eye-pieces 304a, 304b are made from a transparent material, for example, glass or a transparent plastic.

In the example embodiment, the pin-hole flaps 302a, 302b operate independently from the solid flaps 206a, 206b and from each other. That is, pin-hole flap 302a can be closed while solid flap 206a is open, or pin-hole flap 302a can be closed while pin-hole flap 302b is open. Also, the pin-hole flaps 302a, 302b are disposed between the solid flaps 206a, 206b and the eye-pieces 304a, 304b

respectively. Further, it should be noted that Figures 3A-3C show the pin-hole flaps 302a, 302b in a partially open position as an illustration only, so as to distinguish these from the solid flaps 206a, 206b. In actual use, the pin-hole flaps 302a, 302b in the example embodiment are substantially parallel to the solid flaps 206a, 206b when in the open position, so as not to cover the eye-pieces 304a, 304b respectively.

Figure 4 shows a perspective view of a compartment of the first frame member 202 (Figure 2) of the eye occluder 106 (Figure 1) according to an example embodiment. The compartment provides housing for two actuating means 402, 412 and respective electrical and mechanical components related thereto. As the first frame member is substantially symmetrical, a similar compartment is disposed on an opposite side for housing corresponding components of said opposite side. In a preferred embodiment, actuating means 402, 412 comprise electric motors, typically ones which are substantially low-speed, high-torque. Actuating means 402, 412 are separately coupled to the pin-hole flap and solid flap as described above with respect to Figure 3, for independent actuation of the respective flap.

For example, in the example embodiment, rotational motion from the actuating means 402 is transmitted from a gear 404 axially mounted to an output shaft (not shown) of actuating means 402 to a rotating member 408 via a gear 406. A solid flap 206a (Figure 2A) is mounted to the rotating member 408 such that the solid flap 206a rotates in synchronisation with the rotating member 408. Similarly, rotational motion from the actuating means 412 is transmitted from a gear 414 axially mounted to an output shaft (not shown) of actuating means 412 to a rotating member 418 via a gear 416. A pin-hole flap 302a (Figure 3A) is mounted to the rotating member 418 such that the pin-hole flap 302a rotates in synchronisation with the rotating member 418.

In the example embodiment, as two separate actuating means 402, 412 are used on each side and the rotating members 408, 418 are independently rotatable about a shaft 410, the pin-hole flap 302a and solid flap 206a are independently actuated. Thus, the pin-hole flap 302a and solid flap 206a on one side, e.g. the left

side of the test subject, can open/close simultaneously rather than sequentially, thereby advantageously reducing the time for completely opening/closing one side.

In addition, by having two separate actuating means on the opposite compartment in the example embodiment, the opening of the flaps on one side can be simultaneous with the closing of the flaps on the opposite side, thereby advantageously reducing the transition time for switching the test from one eye to another.

In alternate embodiments, a single actuating means may be used to control both the pin-hole flap 302a and solid flap 206a on one side. However, in such embodiments, the mechanism to transmit the rotational motion from the single actuating means to the respective flap needs to be modified and may potentially be more complex than the one described above.

Furthermore, in the example embodiment, the shaft 410 is substantially vertical, thus the pin-hole flap 302a and the solid flap 206a rotate about a substantially vertical axis for opening/closing. In other alternate embodiments, the flaps may be configured to rotate about a substantially horizontal axis, e.g. by re-positioning at least the shaft 410 and/or the actuating means.

Also, as can be seen from Figure 4, resilient members 422, 432 are provided on the first frame member 202 for receiving and securing the actuating means 402, 412 respectively during assembly. The actuating means 402, 412 are further secured to the first frame member 202 via rigid members 420, 430 respectively. Connecting members, e.g. hole 424, are also provided on the first frame member 202 in the example embodiment for coupling to the second frame member 204 (Figure 2A).

Figure 5 shows a partial perspective view of a second frame member 204 (Figure 2A) of the eye occluder according to an example embodiment. The second frame member 204 comprises a circuit board 502, e.g. an integrated circuit (IC), mounted thereon by way of fastening means 514. The circuit board 502 comprises a microcontroller 504 for controlling the actuating means 402, 412 and for processing

signals received from the computing device 104 (Figure 1), and a communication interface 506 for communicating with the computing device 104. As will be appreciated by a person skilled in the art, the circuit board 502 in the example embodiment may comprise other standard components, e.g. connection interfaces (not shown) and a power source (not shown).

In addition, as can be seen from Figure 5, the second frame member 204 comprises openings 510a, 510b where eye-pieces 304a, 304b (Figure 3A) are mounted respectively in the example embodiment. The support member 208 is disposed between the openings 510a and 510b, and is attached to the second frame member 204 using e.g. an adhesive. The second frame member 204 in the example embodiment further comprises connecting members for coupling to the first frame member 202 (Figure 2A). For example, holes 508 mate with corresponding protrusions on the first frame member 202 for a press fit, while lever 512 mates with hole 424 (Figure 4) for a snap fit.

Now referring to Figures 1-5, an example implementation of the visual acuity assessment system 100 is described. The system 100 displays on the display 102, Landolt-C optotypes of varying sizes. In the example embodiment, each Landolt-C optotype of a certain size has possible 4-8 orientations, e.g. left, right, up, down and the 4 slanted orientations in between. The test subject (not shown) situated at a distance from the display 102 uses an input device 110, e.g. a joystick, to try and identify the correct orientation (direction of the gap) of the Landolt-C optotypes. Results of the assessment are captured in a database and/or also printed onto a sticker in the example embodiment.

It will be appreciated that, in the example embodiment, the computing device 104 controls each optotype to be displayed at a random orientation, thus it is not possible for the test subject to memorise any display sequence in advance and influence the test result. Further, the computing device 104 can advantageously adjust the size of the optotype in relation to the distance between the test subject and the display 102 for maintaining test requirements. For example, a distance of 4 m is used in an example embodiment. It will also be appreciated that the system of the example embodiment can work with different eye test charts and is not limited to the Landolt-C eye test chart.

In an example sequence, if the right eye of the test subject is tested first, the computing device 104 controls the actuators to close both the left solid flap 206b and pin-hole flap 302b, thereby substantially covering the left eye of the test subject. In the first stage, both the right solid flap 206a and pin-hole flap 302a are instructed to open. The display 102 typically starts with the Landolt-C optotypes of the largest size, each having its gap at one of the 4 (or 8) orientations randomly. The test subject provides his response, i.e. orientation of the gap of the Landolt-C optotype, via the input device 110 in the example embodiment. The computing device 104 determines if the response is correct such that if the responses are consistently correct (e.g. 3 or more out of 5) at a certain display size, the computing device 104 automatically controls the display 102 to show the Landolt-C optotypes of a next smaller size. It will be appreciated that the termination may be based on other thresholds in alternate embodiments.

At the next smaller size, the above steps of displaying the Landolt-C optotypes at random orientations and determining if the test subject's responses are correct, are repeated. The algorithm continues until a size where responses from the test subject are mostly incorrect, e.g. a percentage of correct responses is below a threshold. The computing device 104 records the size for further analysis and automatically executes a second stage of the test.

At the second stage, a pin-hole test for the right eye is conducted. The left eye flaps remain in the closed position. In addition, the right pin-hole flap 302a is instructed to close while the right solid flap 206a remains in the open position. The steps of displaying the Landolt-C optotypes at random orientations and determining if the test subject's responses are correct are repeated, starting from the same level at which the previous stage ended. Similar as described above, the computing device 104 determines if the response is correct such that if the responses are consistently correct (e.g. 3 or more out of 5) at a certain display size, the computing device 104 automatically controls the display 102 to show the Landolt-C optotypes of a next smaller size. It will be appreciated that the termination may be based on other thresholds in alternate embodiments.

After the second stage is completed, the test is repeated for the left eye using similar steps as described above with respect to the test for the right eye. It should be noted that the test can also start with the left eye first and then repeated for the right eye. It should also be noted that the test sequence can be modified such that the pin-hole test is omitted.

From the results obtained based on the steps as described above, in the example embodiment, the computing device 104 determines and outputs a visual acuity score for each eye to the test subject. It will be appreciated that the output can be in different forms, including display, print, and/or audio output. The score may also be stored in the computing device for monitoring, or comparison, etc.

Figure 6 shows an image illustrating a simulated implementation of a visual acuity assessment system according to an example embodiment. In the image, the spectacles of test subject 602 simulate the eye occluder 106 as described above. The display 102, computing device 104 and input device 110 have the same meaning and functions as described with respect to Figures 1-5.

Figure 7 shows a flow chart 700 illustrating a method for controlling the eye occluder according to an example embodiment. At step 702, both left flap members are closed while both right flap members are kept open. At step 704, a right perforated flap member is closed while both left flap members are kept closed and a right opaque flap member is kept open. At step 706, both right flap members are closed while both left flap members are kept open. At step 708, a left perforated flap member is closed while both right flap members are kept closed and a left opaque flap member is kept open.

In an example embodiment, the right eye is assessed and the assessment ends when a first threshold is reached. The right eye is then assessed with the right pin-hole flap member closed starting from the same level (i.e. element size) at which the first stage ends, and the assessment ends when a second threshold is reached. The above steps are then repeated for the left eye.

Figure 9 shows a flow chart 900 illustrating a visual acuity assessment method according to an example embodiment. At step 902, a display configured to display an element of an eye test chart is provided. At step 904, a computing device coupled to the display is provided for controlling at least a size and orientation of the element of the eye test chart. At step 906, an eye occluder coupled to the computing device is provided. At step 908, the eye occluder is controlled using the computing device for selectively occluding an eye of a test subject.

The method and system of the example embodiment can be implemented on a computer system 800, schematically shown in Figure 8. It may be implemented as software, such as a computer program being executed within the computer system 800, and instructing the computer system 800 to conduct the method of the example embodiment.

The computer system 800 comprises a computer module 802, input modules such as a keyboard 804, mouse 806 and joystick (not shown), and a plurality of output devices such as a display 808, and printer 810.

The computer module 802 is connected to a computer network 812 via a suitable transceiver device 814, to enable access to e.g. the Internet or other network systems such as Local Area Network (LAN) or Wide Area Network (WAN).

The computer module 802 in the example includes a processor 818, a Random Access Memory (RAM) 820 and a Read Only Memory (ROM) 822. The computer module 802 also includes a number of Input/Output (I/O) interfaces, for example I/O interface 824 to the display 808, and I/O interface 826 to the keyboard 804.

The components of the computer module 802 typically communicate via an interconnected bus 828 and in a manner known to the person skilled in the relevant art.

The application program is typically supplied to the user of the computer system 800 encoded on a data storage medium such as a CD-ROM or flash

memory carrier and read utilising a corresponding data storage medium drive of a data storage device 830. The application program is read and controlled in its execution by the processor 818. Intermediate storage of program data maybe accomplished using RAM 820.

It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS

1. A visual acuity assessment system comprising:
a display configured to display an element of an eye test chart;
5 a computing device coupled to the display for controlling at least a size and orientation of the element of the eye test chart; and
an eye occluder coupled to the computing device,
wherein the computing device controls the eye occluder for selectively
occluding an eye of a test subject, and
10 wherein the eye occluder comprises two substantially opaque movable flap members disposed between left and right eyes of a test subject and the display respectively and further comprises two perforated movable flap members disposed between the left and right eyes of a test subject and the two opaque movable flap members respectively.
- 15 2. The system as claimed in claim 1, further comprising an input device coupled to the computing device for inputting the test subject's response to the element being displayed.
- 20 3. The system as claimed in claim 2, wherein the input device comprises one of a group consisting of a joystick, a keyboard, a touch pad, a mouse, a microphone, a tracker ball and a head tracker.
- 25 4. The system as claimed in claims 2 or 3, wherein the computing device controls the size of the element of the eye test chart based on the test subject's response.
- 30 5. The system as claimed in claim 4, wherein the computing device controls the display to display an element of a smaller size if a first threshold is reached based on the test subject's response.
6. The system as claimed in any one of the preceding claims, wherein the eye occluder comprises:

actuating means coupled to each of the opaque movable flap members for actuating an opening or closing of the respective opaque movable flap members.

5 7. The system as claimed in claim 6, wherein an actuation of the left opaque flap member is independent from that of the right opaque flap member.

8. The system as claimed in claim 6 or 7, wherein the eye occluder further comprises actuating means coupled to each of the perforated movable flap members for actuating an opening or closing of the respective perforated movable
10 flap members.

9. The system as claimed in claim 8, wherein an actuation of the left perforated flap member is independent from that of the right perforated flap member.

15 10. The system as claimed in claim 8, wherein an actuation of the perforated flap member disposed on one side is independent from that of the opaque flap member disposed on the same side.

20 11. The system as claimed in any one of claims 6 to 10, wherein the actuating means comprises an electric motor.

12. The system as claimed in any one of claims 6 to 11, wherein the eye occluder further comprises a circuit board comprising:

25 a microcontroller for controlling the actuating means and/or processing signals received from the computing device, and
a communication interface for communicating with the computing device.

30 13. The system as claimed in claim 1, wherein, in an initial assessment, the computing device records the smallest element size correctly identified by one eye of the test subject, and controls the respective perforated movable flap member to cover said eye for a continued assessment starting from said smallest element size.

14. A visual acuity assessment method, the method comprising the steps of:

- providing a display configured to display an element of an eye test chart;
providing a computing device coupled to the display for controlling at least a
5 size and orientation of the element of the eye test chart;
providing an eye occluder coupled to the computing device; and
controlling the eye occluder using the computing device for selectively
occluding an eye of a test subject; and
10 wherein the eye occluder comprises two substantially opaque movable flap
members disposed between left and right eyes of a test subject and the display
respectively, and further comprises two perforated movable flap members disposed
between the left and right eyes of a test subject and the two opaque movable flap
members respectively.

15 15. The method as claimed in claim 14, further comprising providing an
input device coupled to the computing device for inputting the test subject's
response to the element being displayed.

20 16. The method as claimed in claim 15, wherein the input device
comprises one of a group consisting of a joystick, a keyboard, a touch pad, a
mouse, a microphone, a tracker ball and a head tracker.

25 17. The method as claimed in claims 14 or 15, wherein the computing
device controls the size of the element of the eye test chart based on the test
subject's response.

30 18. The method as claimed in claim 17, wherein the computing device
controls the display to display an element of a smaller size if a first threshold is
reached based on the test subject's response.

19. The method as claimed in any one of claims 14 to 18, wherein the eye
occluder comprises:

actuating means coupled to each of the opaque movable flap members for
actuating an opening or closing of the respective opaque movable flap members.

20. The method as claimed in claim 19, wherein an actuation of the left opaque flap member is independent from that of the right opaque flap member.

5 21. The method as claimed in claim 19 or 20, wherein the eye occluder further comprises actuating means coupled to each of the perforated movable flap members for actuating an opening or closing of the respective perforated movable flap members.

10 22. The method as claimed in claim 21, wherein an actuation of the left perforated flap member is independent from that of the right perforated flap member.

23. The method as claimed in claim 21, wherein an actuation of the perforated flap member disposed on one side is independent from that of the opaque flap member disposed on the same side.

24. The method as claimed in any one of claims 19 to 23, wherein the actuating means comprises an electric motor.

20 25. The method as claimed in any one of claims 19 to 24, wherein the eye occluder further comprises a circuit board comprising:

a microcontroller for controlling the actuating means and/or processing signals received from the computing device, and

a communication interface for communicating with the computing device.

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26. The method as claimed in claim 14, wherein, in an initial assessment, the computing device records the smallest element size correctly identified by one eye of the test subject, and controls the respective perforated movable flap member to cover said eye for a continued assessment starting from said smallest element size.

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27. The method as claimed in claim 26, wherein the computing device controls the eye occluder based on the steps of:

closing both flap members on a first side while keeping both flap members on a second side open during the initial assessment;

5 closing a perforated flap member on the second side while keeping both flap members on the first side closed and an opaque flap member on the second side open during the continued assessment.

28. The method as claim in claims 26 or 27, repeated for the other eye of the test subject.

10 29. The method as claimed in any one of claims 14 to 28, further comprising storing results of the visual acuity assessment in a database.

30. A computer storage medium having stored thereon computer code means for instructing a computing device to execute a visual acuity assessment method, the method comprising the steps of:

15 providing a display configured to display an element of an eye test chart;
providing the computing device coupled to the display for controlling at least a size and orientation of the element of the eye test chart;
providing an eye occluder coupled to the computing device; and
20 controlling the eye occluder using the computing device for selectively occluding an eye of a test subject, and

wherein the eye occluder comprises two substantially opaque movable flap members disposed between left and right eyes of a test subject and the display respectively, and further comprises two perforated movable flap members disposed
25 between the left and right eyes of a test subject and the two opaque movable flap members respectively.