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APPARATUS AND METHOD FOR EYE TRACKING TO DETERMINE VIEWER DISINTEREST

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present principles generally relate to an apparatus and method for interacting with a viewer using the viewer's eye gaze. Data from the viewer's eye movement are collected during the displaying of a video content on a screen. The viewer's eye movement is used to indicate the viewer's disinterest in the video content so that an alternative content may be displayed. The viewer's disinterest may also be used to update the user profile which may be used to provide one or more alternative content. The apparatus and method may be employed as an augmented reality (AR) head mounted display (HMD) device.

15 Background Information

This section is intended to introduce a reader to various aspects of art, which may be related to various aspects of the present principles that are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as, e.g., sound, video, graphics and/or GPS data. It is related to a more general concept called mediated reality, in which a view of reality is modified by a computer. As a result, the technology functions by enhancing one's current perception of reality. Augmented reality is the blending of virtual reality (VR) and real life, as developers can create images within applications that blend in with contents in the real world. With AR, users are able to interact with virtual contents in the real world, and are able to distinguish between the two.

One well-known AR device is Google Glass developed by Google X. Google Glass is a wearable computer which has a video camera and a head mounted display in the form of a pair of glasses. In addition, various improvements and apps have also been developed for Google Glass. One such app with the associated improvement is, e.g., GlassGaze developed by IT University of Copenhagen (see <http://eye.itu.dk>). GlassGaze app incorporates a viewer-facing camera in order to track a user's eye gaze for providing user interactions when using the Google Glass.

Eye tracking or eye gaze tracking is the process of measuring the point of eye gaze and the motion of a user's eye relative to the head. For example, US Patent Publication No. 20080143674 A1 to Molander et al., titled *Guides and Indicators for Eye Movement Monitoring Systems* provides some background information on eye tracking methods and systems. There are a number of systems and methods for measuring eye movements. The most popular variant uses video images from which the eye or the pupil position is extracted. Detecting of eye gaze is used in various human computer interaction applications. For some techniques, a user needs to wear a specialized headgear camera in order to fix the positions of the user's eyes, or the user needs an infrared light on a camera to detect the eyes. For other approaches, a user only needs a simple camera for imaging and detecting the user's eye and the user does not have to wear any other equipment.

Most of computer devices today such as laptops, smart-phones and tablets are provided with a user-facing camera for taking selfies or for video conferencing. Recently, eye tracking apps such as Unmoove (see www.unmoove.me) has been developed as a downloadable software application for eye gaze tracking to be used with a portable device such as a cell phone or a tablet. The software uses only the user-facing video camera of a computing device to provide eye gaze tracking so that various user interactions with the computing device may be performed.

SUMMARY OF THE INVENTION

According to an exemplary embodiment of the present principles, an apparatus responsive to an input signal identifying a gaze point of a viewer with respect to a display panel which displays a first content in a display area for generating an output signal in accordance with the gaze point is presented, comprising: a processor configured to determine when the gaze point is within the display area of the display panel and when the gaze point is outside the display area; and the processor being further configured to count a number of times of repeated gaze movements of the viewer, into and out of the display area occurring during a time interval, for generating the output signal when the number of times exceeds a value greater than 1, the generation of the output signal being indicative of reduced interest of the viewer in the first content; and for preventing the output signal from being generated as long as the number of times does not exceed the value.

According to an exemplary embodiment of the present principles, a method is presented, comprising: displaying via a display panel, a first content in a display area of the display panel; detecting a gaze point of a viewer; and determining, via a processor, when the gaze point is within the display area of the display panel and when the gaze point is outside the display area; and counting a number of times of repeated gaze movements of the viewer, into and out of the display area occurring during a time interval, for generating an output signal when the number of times exceeds a value greater than 1, the generation of the output signal being indicative of reduced interest of the viewer in the first content; and for preventing the output signal from being generated as long as the number of times does not exceed the value.

According to an exemplary embodiment of the present principles, a computer program product stored in non-transitory computer-readable storage media is presented, comprising computer-executable instructions for: displaying a first content in a display area of the display panel; detecting a gaze point of a viewer; and determining when the gaze point is within the display area of the display panel and

when the gaze point is outside the display area; and counting a number of times of repeated gaze movements of the viewer, into and out of the display area occurring during a time interval, for generating an output signal when the number of times exceeds a value greater than 1, the generation of the output signal being indicative of reduced interest of the viewer in the first content; and for preventing the output signal from being generated as long as the number of times does not exceed the value.

DETAILED DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following description of embodiments of the present principles taken in conjunction with the accompanying drawings, wherein:

Fig. 1 shows an exemplary process according to the present principles;

Fig. 2 shows an exemplary system according to the present principles; and

Fig. 3A shows an exemplary apparatus and environment according to the present principles;

Fig. 3B shows another exemplary apparatus according to the present principles;

Fig. 4 illustrates yet another exemplary apparatus according to the present principles.

The examples set out herein illustrate exemplary embodiments of the present principles. Such examples are not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION

The present principles recognize that most of the existing eye gaze tracking systems for providing user interactions are constructed to determine a user's interest. That is, most of the systems would determine where a user is focusing on, based on how long the user has been staring or gazing at something. The present

principles, however, recognize that it is also useful and insightful to determine what object a user is not interested in on a display device. Accordingly, the present principles provide an apparatus and method for determining a user's disinterest based on the user's eye gaze on the display panel.

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A user's disinterest is particularly interesting for a merchant such as a media content provider in order for the content provider to be able to customize its recommendations to a viewer. For example, the determined user's disinterest may be readily used to update a user's profile in order to provide a better recommendation. Accordingly, the present principles further recognize that by using eye gaze tracking of a viewer in, e.g., an augmented reality environment, the viewer's disinterest may be automatically determined. That is, for example, data from the viewer's eye movements are collected during the displaying of different content on a screen. The content may be e.g., one or more of a video program being played, an image representing a video and/or audio content, a user interface icon for selecting a function or an item, an object in an AR system, and etc.

Therefore, according to the present principles, an apparatus and a method is provided to collect and process a user's eye movement data in order to determine the user's disinterest in the video content so that, e.g., an alternative content may be displayed. The user's disinterest may also be used to update the user profile which may then be used to provide different alternatives. The apparatus and method according to the present principles may be implemented as an augmented reality (AR) head mounted display (HMD), as mentioned before and to be described in more detail below.

The present description illustrates the present principles. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the present principles and are included within its spirit and scope.

All examples and conditional language recited herein are intended for pedagogical purposes to aid the reader in understanding the present principles and the concepts contributed by the inventors to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions.

Moreover, all statements herein reciting principles, aspects, and embodiments of the present principles, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

Thus, for example, it will be appreciated by those skilled in the art that the block diagrams presented herein represent conceptual views of illustrative circuitry embodying the present principles. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudocode, and the like represent various processes which may be substantially represented in computer readable media and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term "processor" or "controller" should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor ("DSP") hardware, read-only memory ("ROM") for storing software, random access memory ("RAM"), and non-volatile storage.

Other hardware, conventional and/or custom, may also be included. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the implementer as more specifically understood from the context.

In the claims hereof, any element expressed as a means for performing a specified function is intended to encompass any way of performing that function including, for example, a) a combination of circuit elements that performs that function or b) software in any form, including, therefore, firmware, microcode or the like, combined with appropriate circuitry for executing that software to perform the function. The present principles as defined by such claims reside in the fact that the functionalities provided by the various recited means are combined and brought together in the manner which the claims call for. It is thus regarded that any means that can provide those functionalities are equivalent to those shown herein.

Reference in the specification to "one embodiment", "an embodiment", "an exemplary embodiment" of the present principles, or as well as other variations thereof, means that a particular feature, structure, characteristic, and so forth described in connection with the embodiment is included in at least one embodiment of the present principles. Thus, the appearances of the phrase "in one embodiment", "in an embodiment", "in an exemplary embodiment", or as well any other variations, appearing in various places throughout the specification are not necessarily all referring to the same embodiment.

It is to be appreciated that the use of any of the following "/", "and/or", and "at least one of", for example, in the cases of "A/B", "A and/or B" and "at least one of A and B", is intended to encompass the selection of the first listed option (A) only, or the selection of the second listed option (B) only, or the selection of both options (A

and B). As a further example, in the cases of "A, B, and/or C" and "at least one of A, B, and C", such phrasing is intended to encompass the selection of the first listed option (A) only, or the selection of the second listed option (B) only, or the selection of the third listed option (C) only, or the selection of the first and the second listed options (A and B) only, or the selection of the first and third listed options (A and C) only, or the selection of the second and third listed options (B and C) only, or the selection of all three options (A and B and C). This may be extended, as readily apparent by one of ordinary skill in this and related arts, for as many items listed.

FIG. 2 shows an exemplary system according to the present principles. For example, a system 200 in FIG. 2 includes a content server 205 which is capable of receiving and processing user requests from one or more of user devices 260-1 to 260-n. The content server 205, in response to the user requests, provides program contents comprising various media assets such as movies or TV shows for viewing, streaming or downloading by users using the devices 260-1 to 260-n.

Various exemplary user devices 260-1 to 260-n in FIG. 2 may communicate with the exemplary server 205 over a communication network 250 such as the Internet, a wide area network (WAN), and/or a local area network (LAN). Server 205 may communicate with user devices 260-1 to 260-n in order to provide and/or receive relevant information such as metadata, web pages, media contents, and etc., to and/or from user devices 260-1 to 260-n. Server 205 may also provide additional processing of information and data when the processing is not available and/or capable of being conducted on the local user devices 260-1 to 260-n. As an example, server 205 may be a computer having a processor 210 such as, e.g., an Intel processor, running an appropriate operating system such as, e.g., Windows 2008 R2, Windows Server 2012 R2, Linux operating system, and etc.

User devices 260-1 to 260-n shown in FIG. 2 may be one or more of, e.g., a PC, a laptop, a tablet, a cellphone, Google Glass, or a video receiver, each with its own user-facing video camera for detecting and processing a gaze point of a user.

The user devices may also be one of the above mentioned devices working in connection with an augmented reality or virtual reality eye glasses such as Oculus Rift (see www.oculus.com), PlayStation VR (from Sony), or Gear VR (from Samsung), etc. A detailed block diagram of an exemplary user device according to the present principles is illustrated in block 260-1 of FIG. 2 as Device 1 and will be further described below.

An exemplary user device 260-1 in FIG. 2 comprises a processor 265 for processing various data and for controlling various functions and components of the device 260-1, including video decoding and processing to play and display a content. The processor 265 communicates with and controls the various functions and components of the device 260-1 via a control bus 275 as shown in FIG. 2.

One of the components under the control of the processor 265 is a video camera 290 for eye movement or eye gaze detection. Video camera 290, under the control of processor 265, detects, monitors and processes eye movements of a user and collect eye gaze positions and a time for each eye gaze of the user. The collected eye gaze data are processed under the control of processor 265. As is already mentioned above, eye gaze tracking and eye gaze data collection techniques for a user's eye gaze are well known. For example, camera 290 in combination with processor 265 may employ three steps to realize the eye gaze tracking. In a first step, an eye or eyes on a user's face is detected based on the Haar-like features. In a second step, the tracking of the motion of the eye is performed using the Lucas Kanade algorithm. Finally, in a third step, the eye gaze is detected using Gaussian processes. A person skilled in the art would readily recognize that the above-described process is not the only solution for the eye gaze tracking and that many other techniques may be used for the eye gaze tracking without departing from the spirit of the present principles.

In addition, exemplary device 260-1 in Fig. 2 may also comprise other user input/output (I/O) devices 280 which may comprise, e.g., a touch and/or a physical

keyboard for inputting user data, and/or a speaker, and/or other indicator devices, for outputting visual and/or audio user data and feedback. Device 260-1 may also comprise a display 292 which is driven by a display driver/bus component 287 under the control of processor 265 via a display bus 288 as shown in FIG. 2. In one
5 exemplary embodiment, the display 292 is capable of displaying AR content. The type of the display 292 may be, e.g., LCD (Liquid Crystal Display), LED (Light Emitting Diode), OLED (Organic Light Emitting Diode), and etc. In addition, an exemplary user device 260-1 according to the present principles may have its display outside of the user device, or that an additional or a different external display
10 may be used to display the content provided by the display driver/bus component 287. This is illustrated, e.g., by an external display 291 which is connected to an external display bus/interface 289 of device 260-1 of FIG. 2.

Exemplary device 260-1 also comprises a memory 285 which may represent
15 both a transitory memory such as RAM, and a non-transitory memory such as a ROM, a hard drive or a flash memory, for processing and storing different files and information as necessary, including computer program products and software (e.g., as represented by a flow chart diagram of FIG. 1 to be discussed below), webpages, user interface information, metadata including electronic program listing information,
20 databases, and etc., as needed. In addition, Device 260-1 also comprises a communication interface 270 for connecting and communicating to/from server 205 and/or other devices, via, e.g., network 250 using e.g., a connection through a cable network, a FIOS network, a Wi-Fi network, and/or a cellphone network (e.g., 3G, 4G, LTE), and etc.

25 User devices 260-1 to 260-n in Fig. 2 may access different media assets, web pages, services or databases provided by server 205 using, e.g., HTTP protocol. A well-known web server software application which may be run by server 205 to provide web pages is Apache HTTP Server software available from
30 <http://www.apache.org>. Likewise, examples of well-known media server software applications include Adobe Media Server and Apple HTTP Live Streaming (HLS)

Server. Using media server software as mentioned above and/or other open or proprietary server software, server 205 may provide media content services similar to, e.g., Amazon.com, Netflix, or M-GO. Server 205 may use a streaming protocol such as e.g., Apple HTTP Live Streaming (HLS) protocol, Adobe Real-Time
5 Messaging Protocol (RTMP), Microsoft Silverlight Smooth Streaming Transport Protocol, and etc., to transmit various programs comprising various media assets such as, e.g., video programs, audio programs, movies, TV shows, software, games, electronic books, electronic magazines, electronic articles, and etc., to an end-user device 260-1 for purchase and/or viewing via streaming, downloading, receiving or
10 the like.

Web server 205 comprises a processor 210 which controls the various functions and components of the server 205 via a control bus 207 as shown in FIG. 2. In addition, a server administrator may interact with and configure server 205 to
15 run different applications using different user input/output (I/O) devices 215 (e.g., a keyboard and/or a display) as well known in the art. Server 205 also comprises a memory 225 which may represent both a transitory memory such as RAM, and a non-transitory memory such as a ROM, a hard drive or a flash memory, for processing and storing different files and information as necessary, including
20 computer program products and software (e.g., as represented by a flow chart diagram of FIG. 1), webpages, user interface information, user profiles, metadata including electronic program listing information, databases, search engine software, and etc., as needed. A search engine and related databases may be stored in the non-transitory memory 225 of server 205 as necessary, so that media
25 recommendations may be made, e.g., in response to a user's profile of disinterest and/or interest in certain media assets, and/or criteria that a user specifies using textual input (e.g., queries using "sports", "adventure", "Tom Cruise", and etc.), as to be described in more detail below.

30 In addition, server 205 is connected to network 250 through a communication interface 220 for communicating with other servers or web sites (not shown) and to

one or more user devices 260-1 to 260-n, as shown in FIG. 2. The communication interface 220 may also represent television signal modulator and RF transmitter in the case of when the content provider 205 represents a television station, cable or satellite television provider. In addition, one skilled in the art would readily appreciate that other well-known server components, such as, e.g., power supply, cooling fans, etc., may also be needed, but are not shown in FIG. 2 to simplify the drawing.

FIG. 1 represents a flow chart diagram of an exemplary process 100 according to the present principles. Process 100 may be implemented as a computer program product comprising computer executable instructions which may be executed by e.g., processor 265 of device 260-1 and/or processor 210 of server 205 of FIG. 2. The computer program product having the computer-executable instructions may be stored in a non-transitory computer-readable storage media as represented by e.g., memory 285 and/or memory 225 of FIG. 2. One skilled in the art can readily recognize that the exemplary process shown in FIG. 1 may also be implemented using a combination of hardware and software (e.g., a firmware implementation), and/or executed using programmable logic arrays (PLA) or application-specific integrated circuit (ASIC), etc., as already mentioned above.

The process 100 is invoked at 110 of FIG. 1 and proceeds to step 120. At step 120 of Fig. 1, an initial calibration or a pre-calibration of the eye gaze detection may be performed by device 260-1 in Fig. 2 as necessary. This may be performed, e.g., when a user first purchases the computing device, or when a new user is using the device.

At step 130 of Fig. 1, a first content is displayed in a display area of a display panel of e.g., user device 260-1 of Fig. 2. This is also shown in an illustration of Fig. 4. Fig. 4 shows that a first content 440 is being displayed in a display area 430 of a display panel 410. The display panel 410 may be, for example, an internal display 292 or an external display 291 shown in Fig. 2 of a user device 260-1 as already

described before. Also, as described before, content 440 may represent e.g., one or more of a video program being played, an image representing a video and/or audio content, a user interface icon for selecting a function or an item, an object in an AR system, and etc.

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At step 140 of Fig. 1, a gaze point of a viewer is detected by e.g., user device 260-1 of Fig. 2. This is also illustrated in Fig. 4. Fig. 4 shows an eye 470 of a viewer having a first and a second gaze. A first gaze point 461 is shown having a first gaze path 462 from the viewer's eye 470. A second gaze point 463 is also shown, having a second gaze path 464 from the same viewer's eye 470. As it can be seen, the first gaze point 461 falls within the display area 430 and the second gaze point falls outside of the display area 430 of Fig. 4. As described previously in connection with Fig. 2, video camera 290 under the control of processor 265 of device 260-1, detects, monitors and processes eye movements of a viewer and collects and determines eye gaze positions and a time for each eye gaze of the viewer.

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Although illustrating the display area 430 as occupying a portion of the screen of the display panel 410, the display area 430 can be the entire screen of the display panel 410.

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At step 150 of Fig. 1, gaze points of a viewer are collected, determined and analyzed during a given time interval. For example, processor 265 of device 260-1 determines if a gaze point of the viewer is within a display area 430, such as, e.g., gaze point 461 shown in Fig. 4. Processor 265 of device 260-1 also determines that if a gaze point of the viewer is outside of the display area 430, such as, e.g., gaze point 463 shown in Fig. 4. Processor 265 of device 260-1 then counts the number of times of repeated gaze movements of the viewer, into and out of the display area 430 occurring during the time interval, as illustrated by the double-sided arrow 450 shown in Fig. 4. According to the present principles, various time intervals may be selected as necessary, such as, e.g., 2 to 20 seconds, or longer.

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At step 160 of Fig. 1, processor 265 of device 260-1 determines if the number of times of the viewer's repeated gaze movements into and out of the display area occurring during the time interval is greater than a certain value. The threshold value may be any value greater than 1, for example, 2 to 10 repetitions.

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At step 170 of Fig. 1, if the number of times exceeds the value as determined at step 160, then an output signal is generated by processor 265 of device 260-1 indicative of reduced interest of the viewer in the first content. Also at step 160, if this threshold value is not exceeded during the selected time interval, then process 100 returns to step 150, and the time interval and the count of the repeated gaze movements is reset to zero and a new counting is initiated at step 150. Accordingly, the output signal indicative of a viewer's disinterest is prevented from being generated by processor 265 of device 260-1 as long as the number of times does not exceed the value.

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At step 180 of Fig. 1, in one exemplary embodiment, if device 260-1 determines that a user has shown disinterest in the first content 440 as determined in the steps described above, then the first content 440 shown in a first display area 430 may be substituted with a second content 490 shown in a second display area 480 of the same display 410, as illustrated in Fig. 4. In another embodiment, the display areas 430 and 480 are the same area.

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At step 190, the indication of the disinterest of a viewer in the content 440 as determined in the steps described above are used to automatically update a user profile associated with the user. The user profile may comprise user information for a user such as the user's likes and dislikes of different categories and types of shows based on user's viewing habits or a user survey. The user profile is updated accordingly to provide recommendations of content by a content provider. Therefore, according to the present principles, the updated user profile which takes into account of the determined user's disinterest, may be used to provide substitute content for the viewer, as shown in Fig. 4. In an exemplary embodiment, first content 440 of

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Fig. 4 may represent one or more user recommendations according to a user profile, and second content 490 of Fig. 4 may represent the substituted one or more other user recommendations based on an updated profile in accordance with the present principles. Therefore, the first content 440 and the second content 490 may each contain a plurality of images representing recommended programs suggested by a media content provider.

Fig. 3A illustrates an exemplary environment of the use of an exemplary computer device 260-1 of Fig. 2 according to an embodiment of the present principles. Fig. 3A shows a user 12 reading or browsing contents presented on a display of the device 11 (which corresponds to device 260-1 of Fig. 2), as already described in detail above. The device 11 is equipped with a camera 10 (which corresponds to camera 290 of device 260-1 of Fig. 2) for imaging the face and eye(s) of the user 12 in order to monitor the movement of the eye(s). As already described in detail above, camera 10 captures the images of the face and eye(s) of user 12 and detects eye gaze points of the user 12 under the control of a processor such as processor 265 of device 260-1 of Fig. 2.

Fig. 3B illustrates another exemplary device 260-1 of Fig. 2 in the form of an augmented reality (AR) head mounted display (HMD) device. As shown in Fig. 3B, the HMD device 14 has a viewer-facing camera 16 which corresponds to camera 290 of device 260-1 of Fig. 2 for detecting the eye movements of a user in order to monitor the eye gaze of the user. A processor which corresponds to processor 265 of device 260-1 of Fig. 2 is embedded in a housing 15 of the HMD device 14. In addition, an AR display 17 which corresponds to a display 292 of device 260-1 in Fig. 2 is mounted in front of the viewer's eyes for providing AR image display in accordance with the present principles.

While several embodiments have been described and illustrated herein, those of ordinary skill in the art will readily envision a variety of other means and/or structures for performing the functions and/or obtaining the results and/or one or

more of the advantages described herein, and each of such variations and/or modifications is deemed to be within the scope of the present embodiments. More generally, those skilled in the art will readily appreciate that all parameters, dimensions, materials, and configurations described herein are meant to be
5 exemplary and that the actual parameters, dimensions, materials, and/or configurations will depend upon the specific application or applications for which the teachings herein is/are used. Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, many equivalents to the specific embodiments described herein. It is, therefore, to be understood that the
10 foregoing embodiments are presented by way of example only and that, within the scope of the appended claims and equivalents thereof, the embodiments disclosed may be practiced otherwise than as specifically described and claimed. The present embodiments are directed to each individual feature, system, article, material and/or method described herein. In addition, any combination of two or more such
15 features, systems, articles, materials and/or methods, if such features, systems, articles, materials and/or methods are not mutually inconsistent, is included within the scope of the present embodiment.

CLAIMS

1. An apparatus responsive to an input signal identifying a gaze point of a viewer with respect to a display panel which displays a first content in a display area
5 for generating an output signal in accordance with the gaze point, comprising:

a processor configured to determine when the gaze point is within the display area of the display panel and when the gaze point is outside the display area; and

the processor being further configured to count a number of times of repeated gaze movements of the viewer, into and out of the display area occurring during a
10 time interval, for generating the output signal when the number of times exceeds a value greater than 1, the generation of the output signal being indicative of reduced interest of the viewer in the first content; and for preventing the output signal from being generated as long as the number of times does not exceed the value.

15 2. The apparatus according to claim 1 wherein the generation of the output signal causes the first content to be substituted by a second content.

3. The apparatus according to claim 2 wherein the second content is selected in accordance with a profile associated with the viewer, wherein the profile
20 indicates a type of content of interest to the viewer.

4. The apparatus according to claim 1 wherein the output signal is used for updating a profile associated with the viewer to indicate a type of content that is of reduced interest to the viewer.
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5. The apparatus according to claim 1 wherein the display panel is included in a head mounted display of a video apparatus having augmented reality display capability.

30 6. The apparatus according to claim 1 wherein the first content is a video program being played.

7. The apparatus according to claim 6 wherein the second content is a plurality of images representing alternative programs.

8. The apparatus according to claim 4 wherein the profile further
5 comprising viewing habits of the viewer.

9. A method comprising:
displaying via a display panel, a first content in a display area of the display
panel;
10 detecting a gaze point of a viewer; and
determining, via a processor, when the gaze point is within the display area of
the display panel and when the gaze point is outside the display area; and counting
a number of times of repeated gaze movements of the viewer, into and out of the
display area occurring during a time interval, for generating an output signal when
15 the number of times exceeds a value greater than 1, the generation of the output
signal being indicative of reduced interest of the viewer in the first content; and for
preventing the output signal from being generated as long as the number of times
does not exceed the value.

20 10. The method according to claim 9 wherein the generation of the output
signal causes the first content to be substituted by a second content.

11. The method according to claim 10 wherein the second content is
selected in accordance with a profile associated with the viewer, wherein the profile
25 indicates a type of content of interest to the viewer.

12. The method according to claim 9 wherein the output signal is used for
updating a profile associated with the viewer to indicate a type of content that is of
reduced interest the viewer.

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13. The method according to claim 9 wherein the display panel is included in a head mounted display of a video apparatus having augmented reality display capability.

5 14. The method according to claim 9 wherein the first content is a video program being played.

15. The method according to claim 9 wherein the second content is a plurality of images representing alternative programs.

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16. The method according to claim 12 wherein the profile further comprising additional viewing habits of the viewer.

17. A computer program product stored in non-transitory computer-readable storage media comprising computer-executable instructions for:
15 displaying a first content in a display area of the display panel;
detecting a gaze point of a viewer; and
determining when the gaze point is within the display area of the display panel and when the gaze point is outside the display area; and counting a number of
20 times of repeated gaze movements of the viewer, into and out of the display area occurring during a time interval, for generating an output signal when the number of times exceeds a value greater than 1, the generation of the output signal being indicative of reduced interest of the viewer in the first content; and for preventing the
25 output signal from being generated as long as the number of times does not exceed the value.

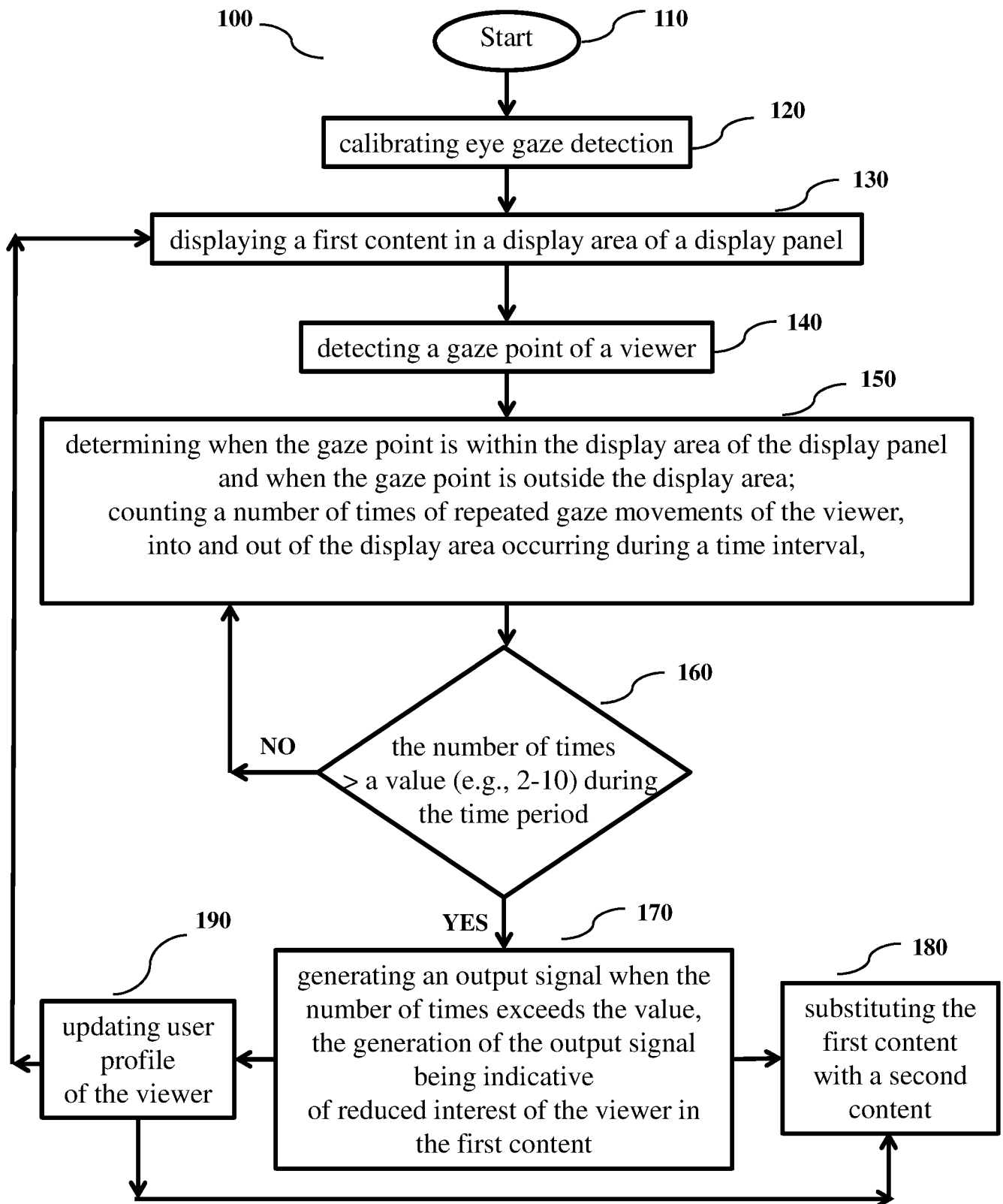


Fig. 1

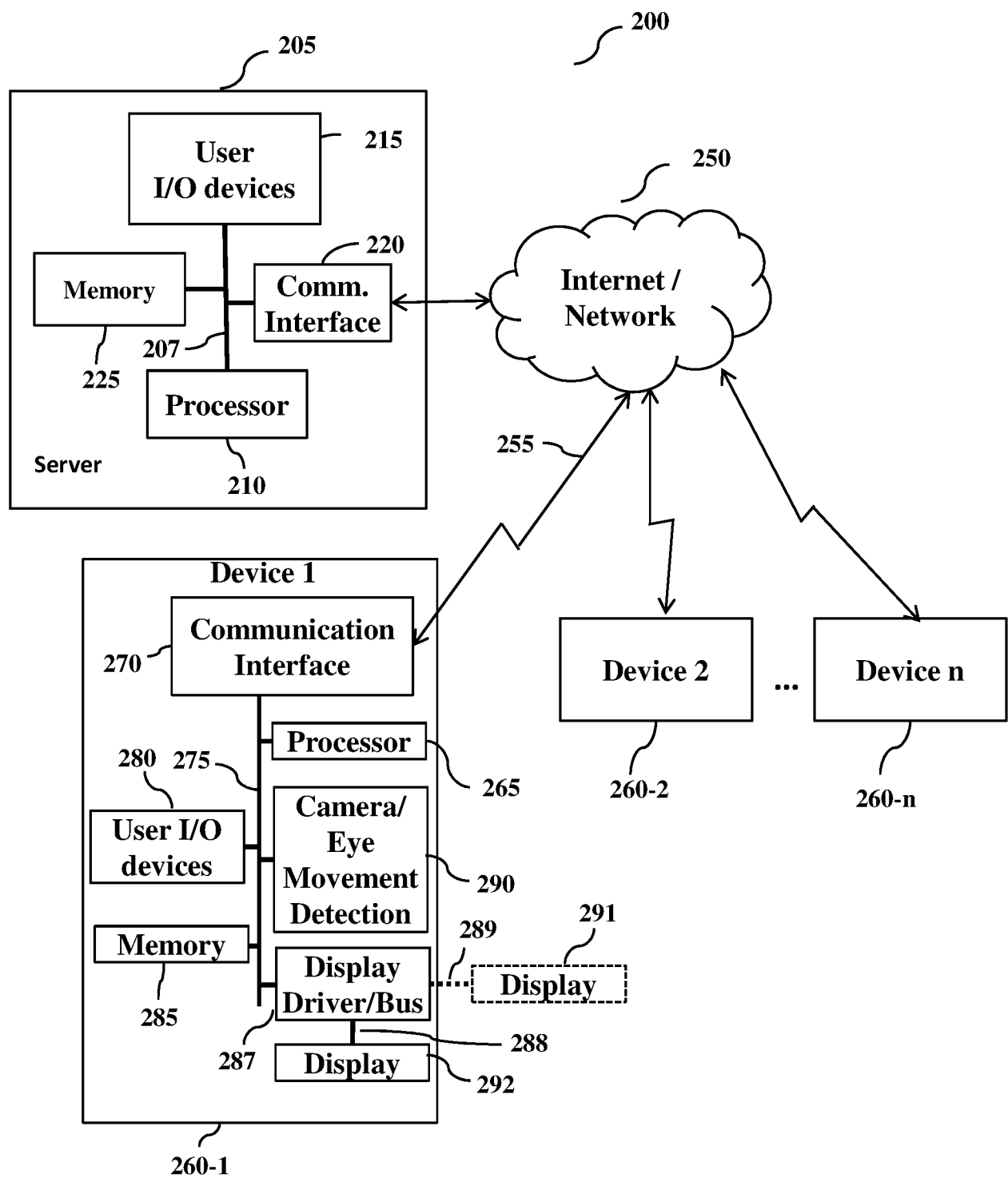


Fig. 2

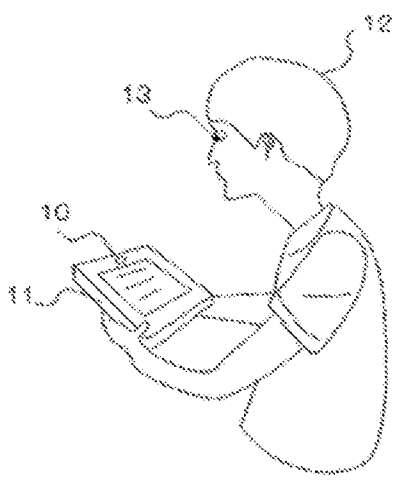


Fig. 3A

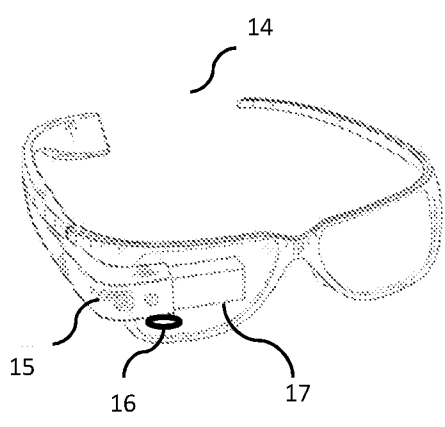


Fig. 3B

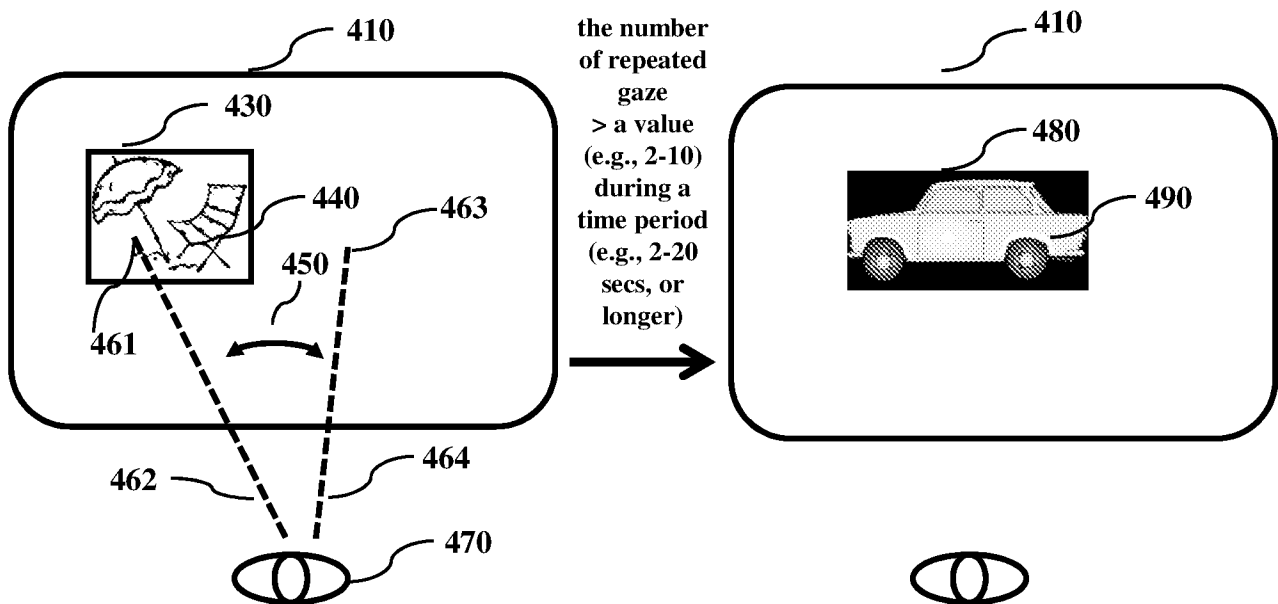


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/030651

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F3/01 H04N21/442 H04N21/45
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 2015/189387 A1 (GOLYSHKO PHIL [US] ET AL) 2 July 2015 (2015-07-02) abstract; figures 1-8 paragraphs [0023], [0047] - [0051], [0068], [0073] - [0075], [0081], [0102] - [0107], [0126], [0135] ----- -/--	1,2,5,6, 8-10,13, 14,16,17



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

28 September 2016

Date of mailing of the international search report

07/10/2016

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/030651

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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International application No

PCT/US2016/030651

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