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(54) **COMPUTATIONAL USER-HEALTH TESTING**

Related U.S. Application Data

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(57) **ABSTRACT**

Methods, apparatuses, computer program products, devices and systems are described that carry out obtaining user-health data; selecting at least one user-health test function at least partly based on the user-health data; and applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection.

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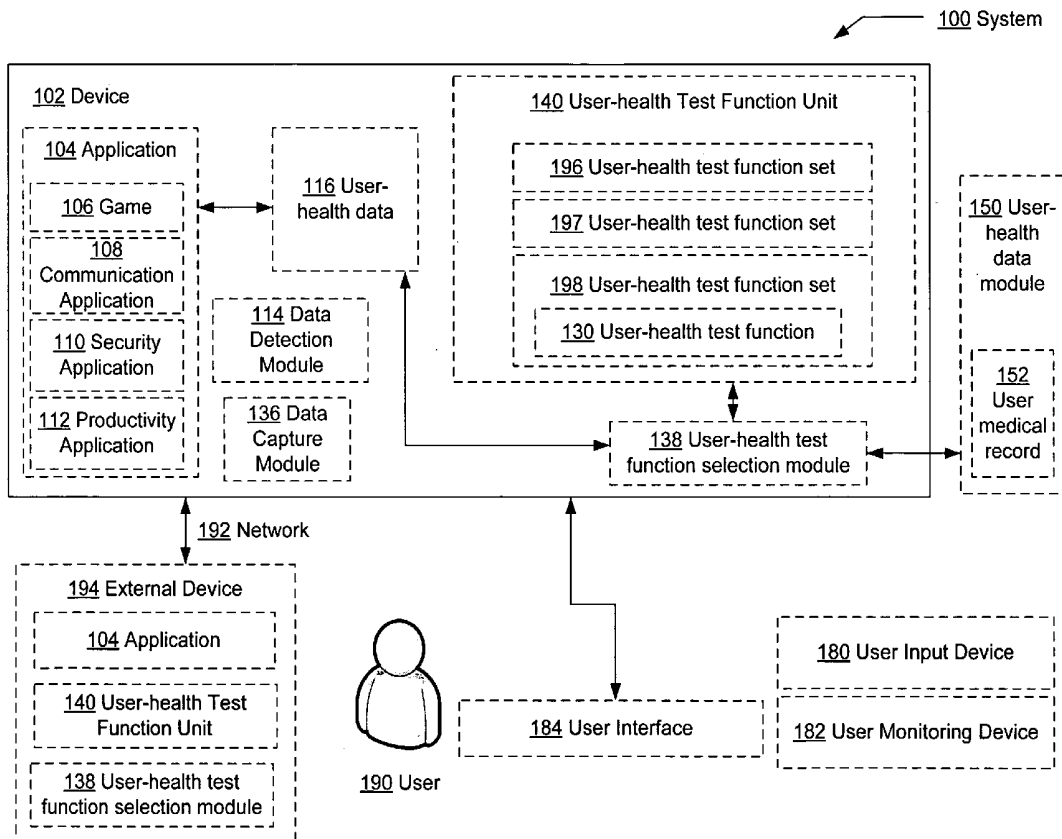


FIG. 1

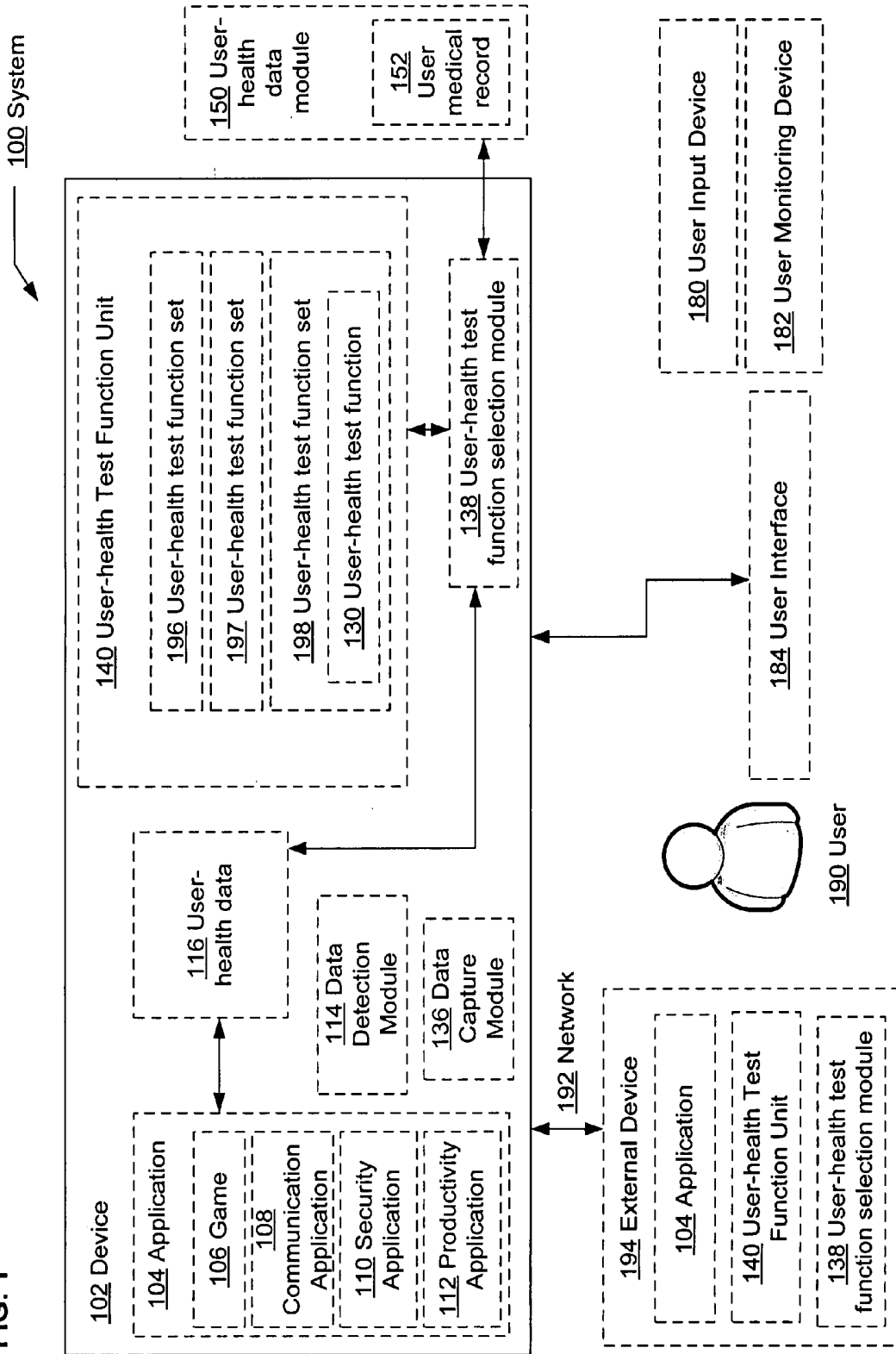


FIG. 2

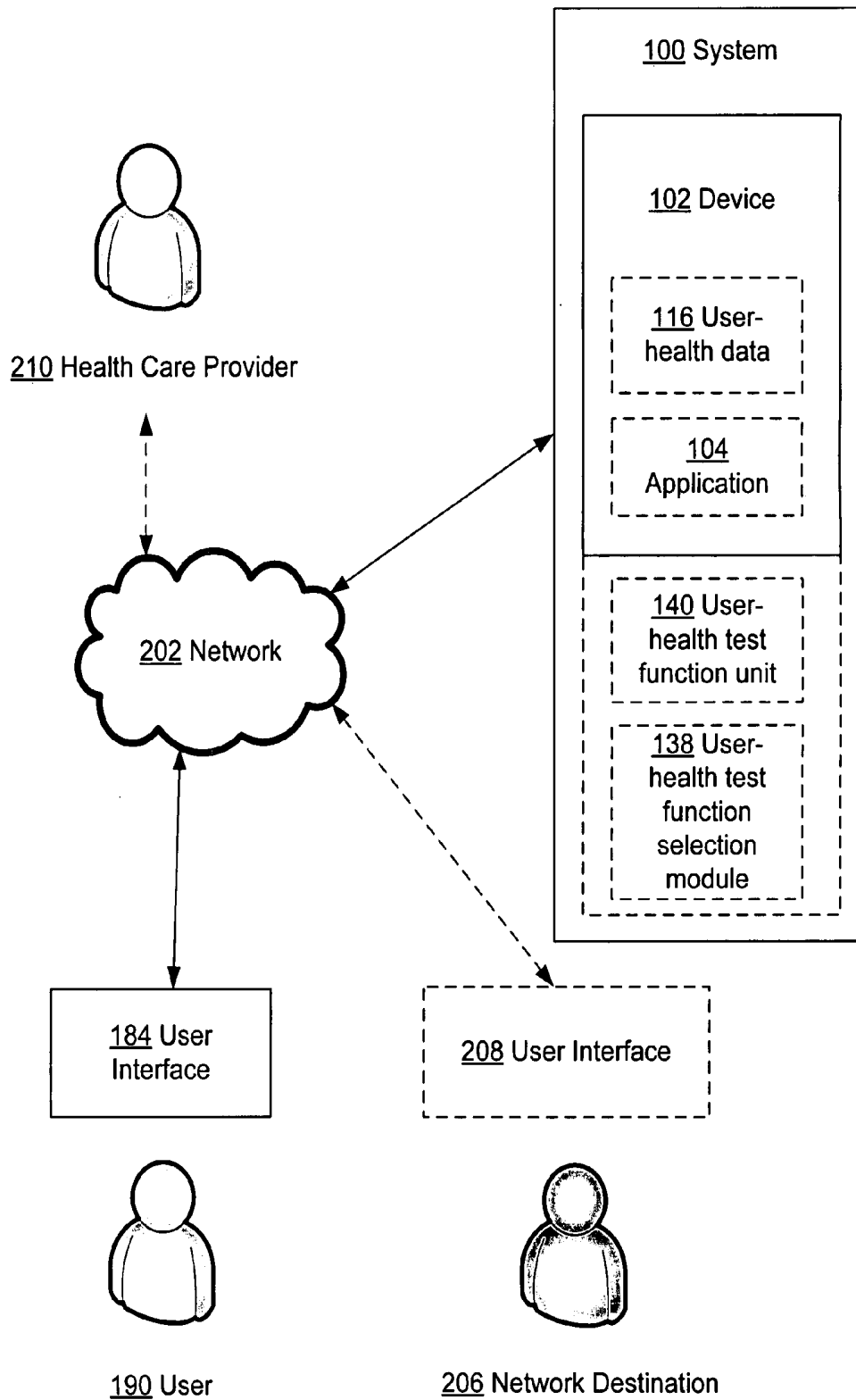
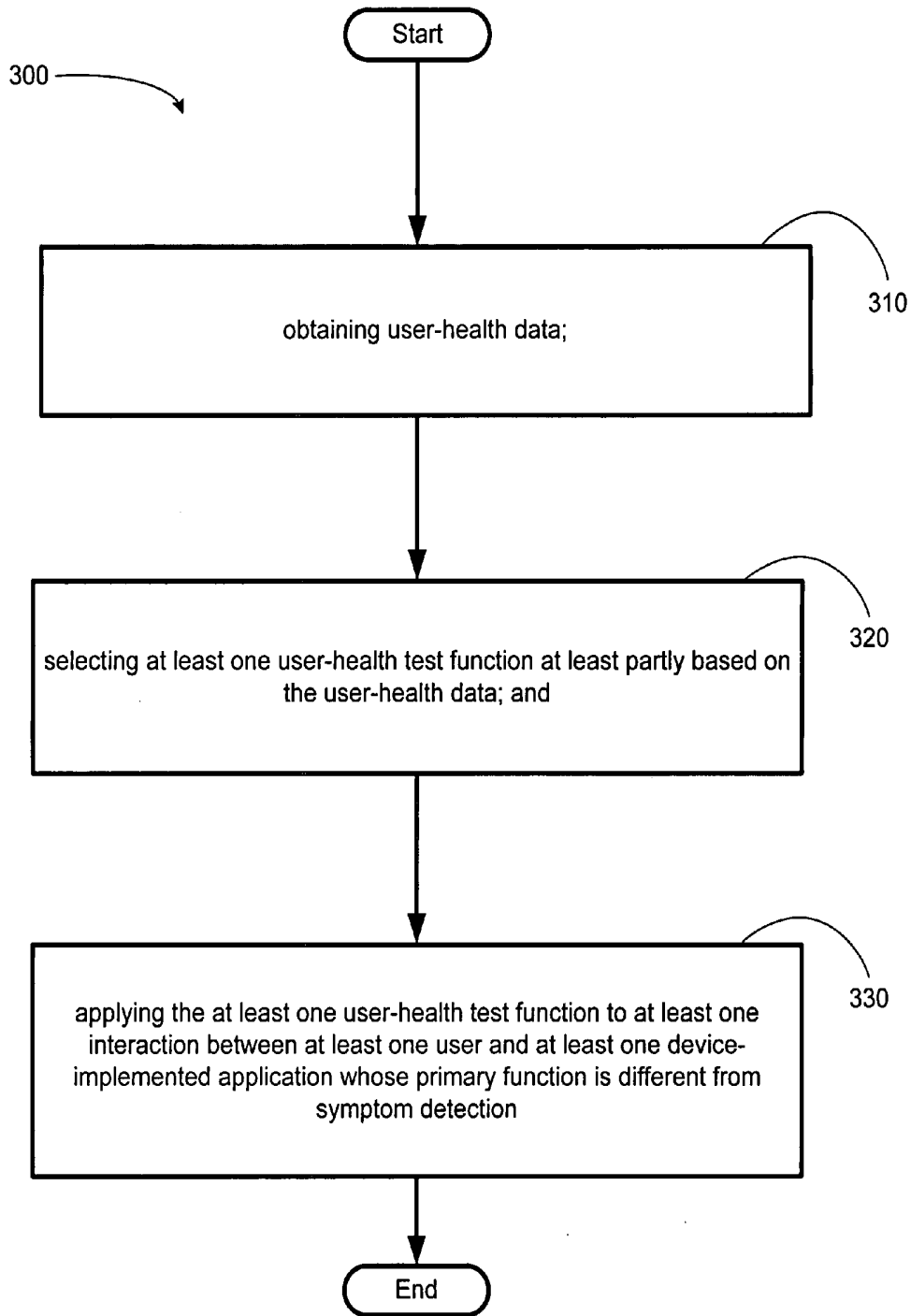
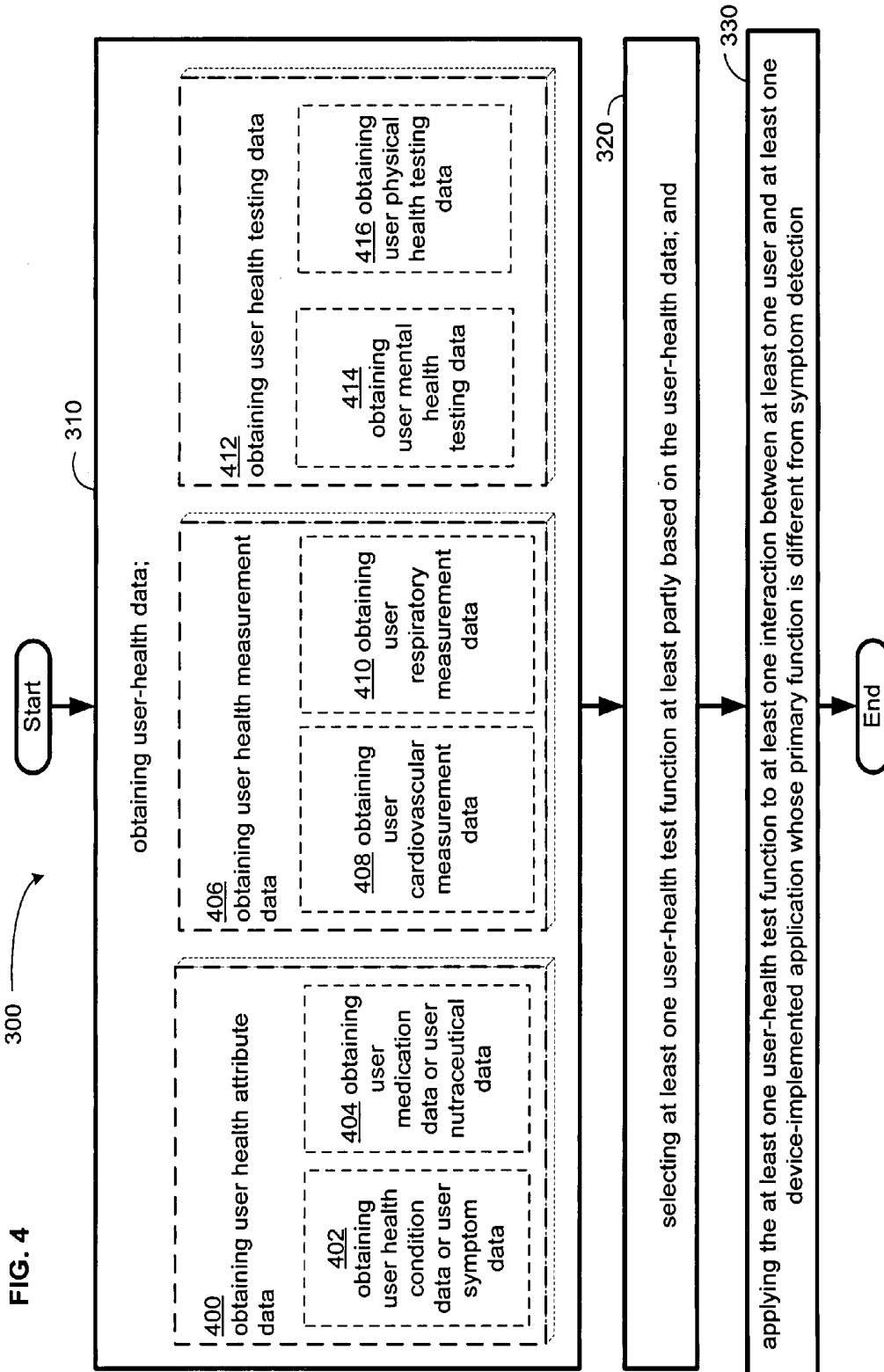
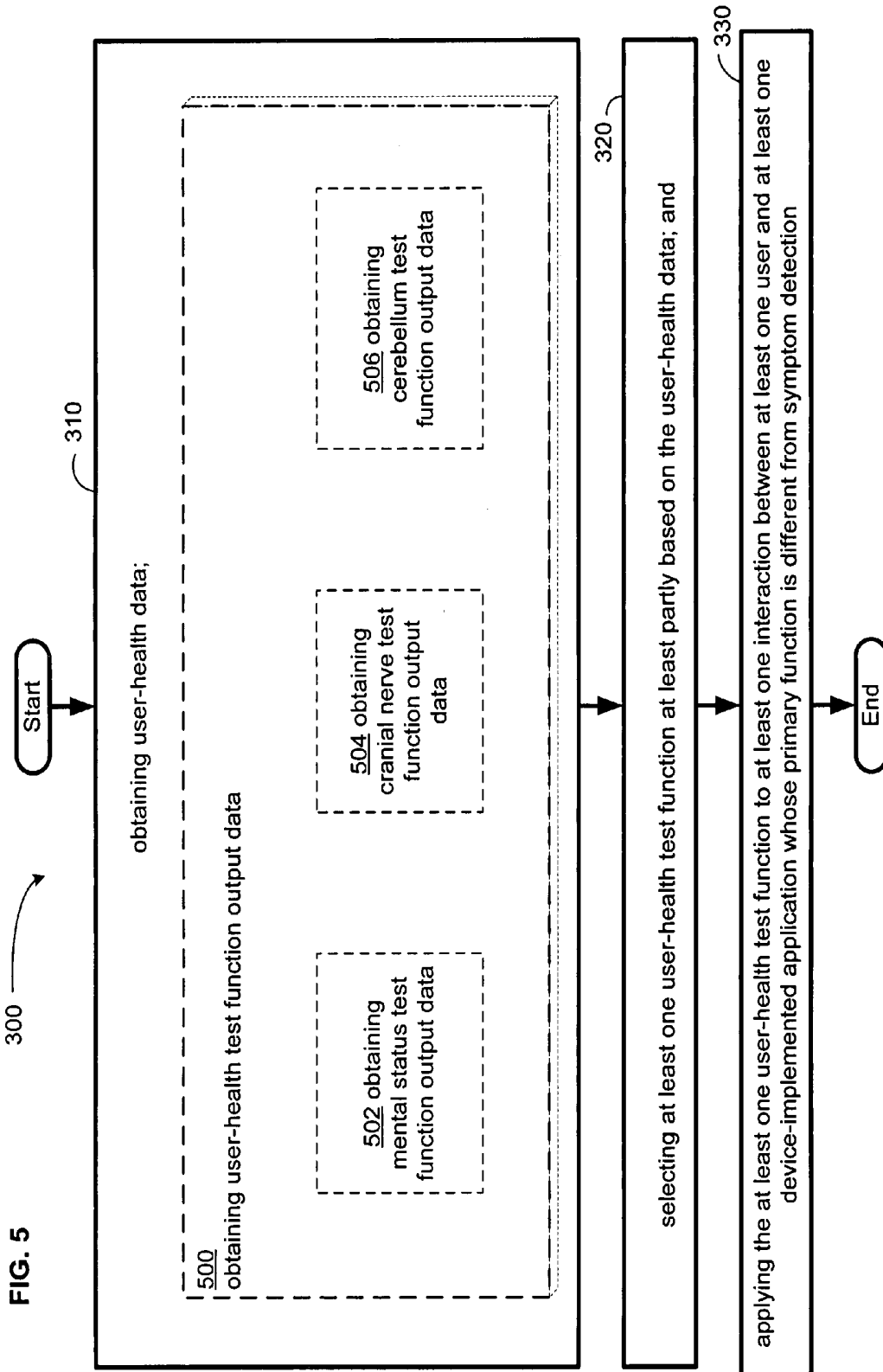


FIG. 3







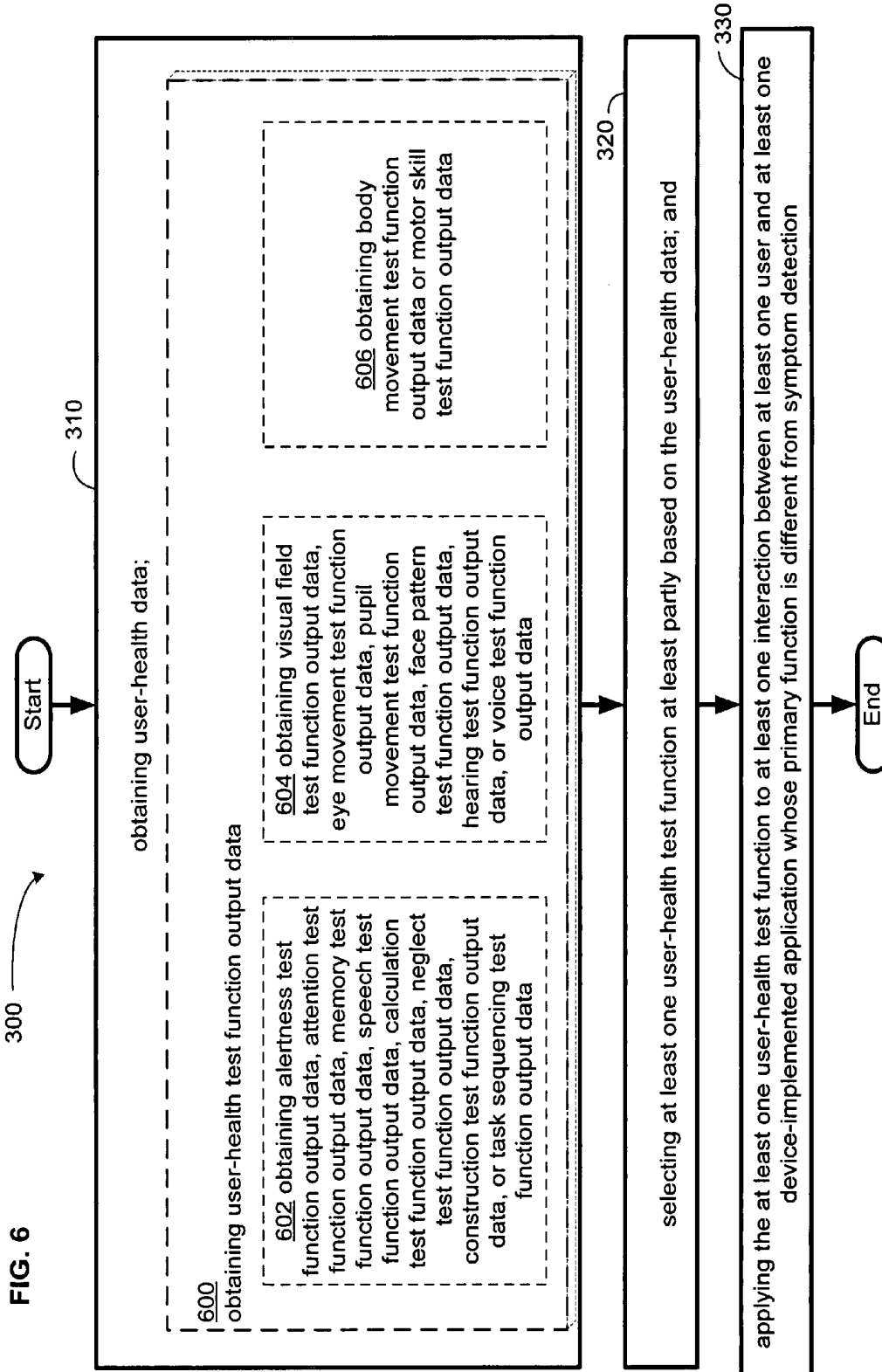
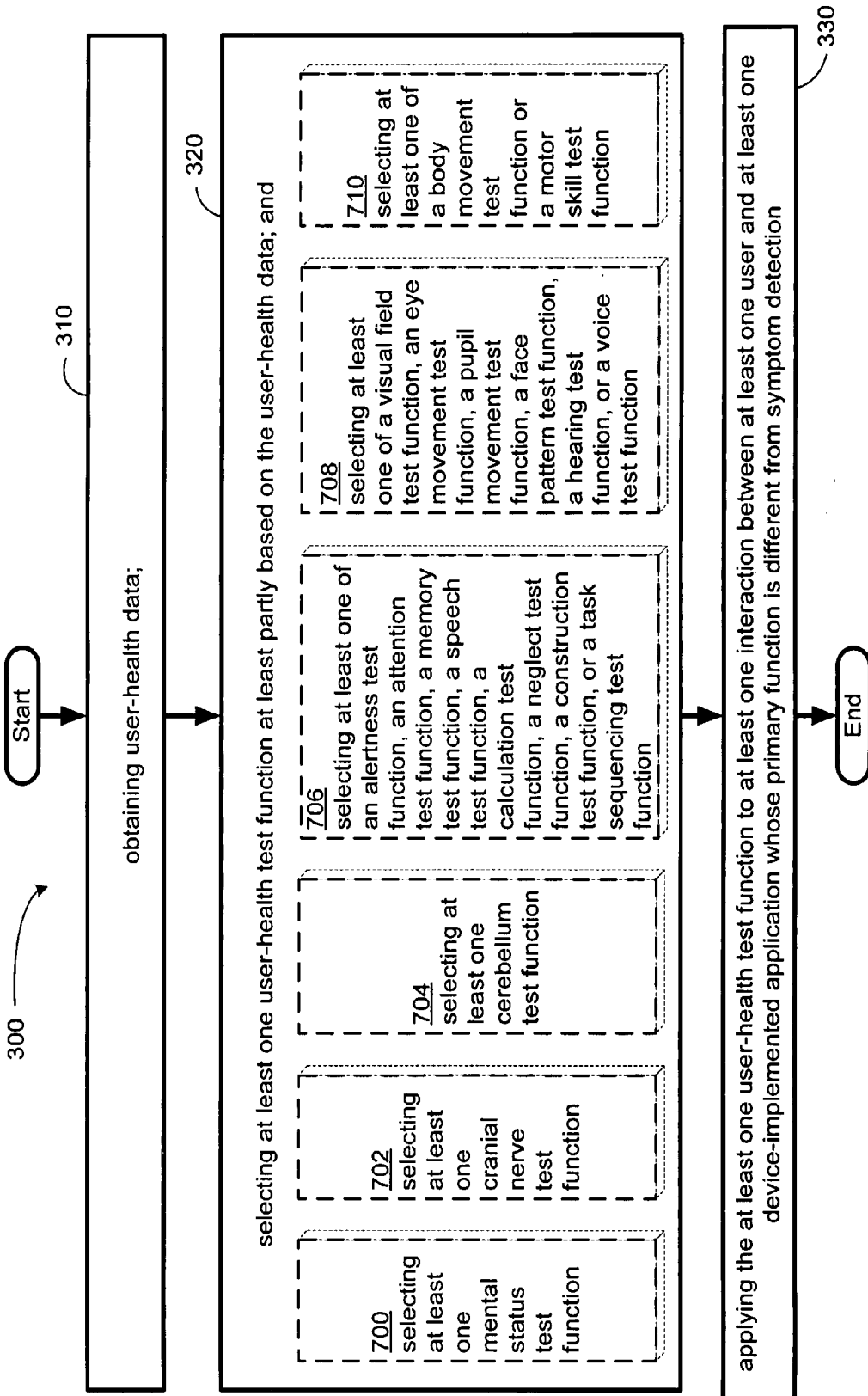
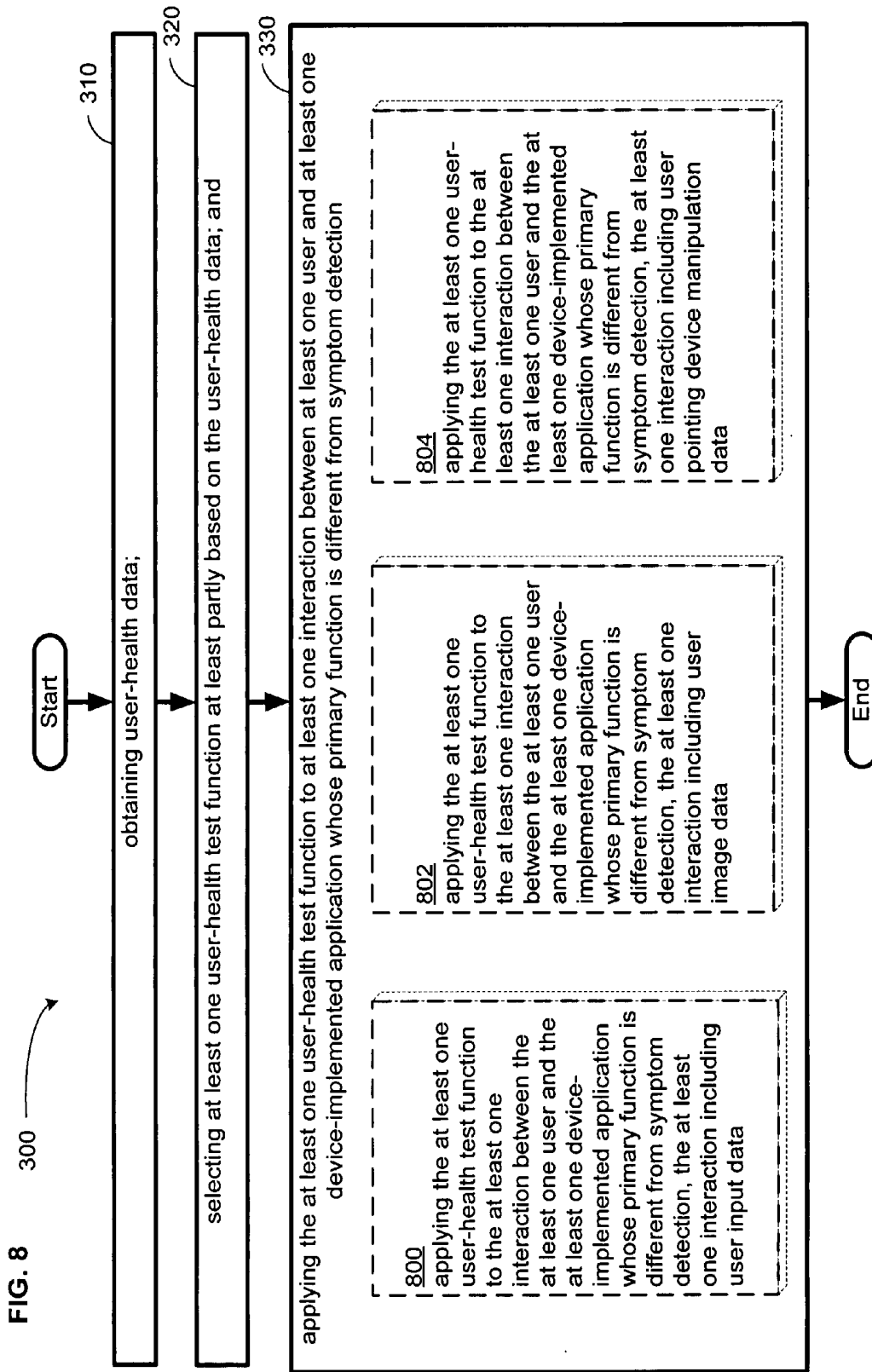
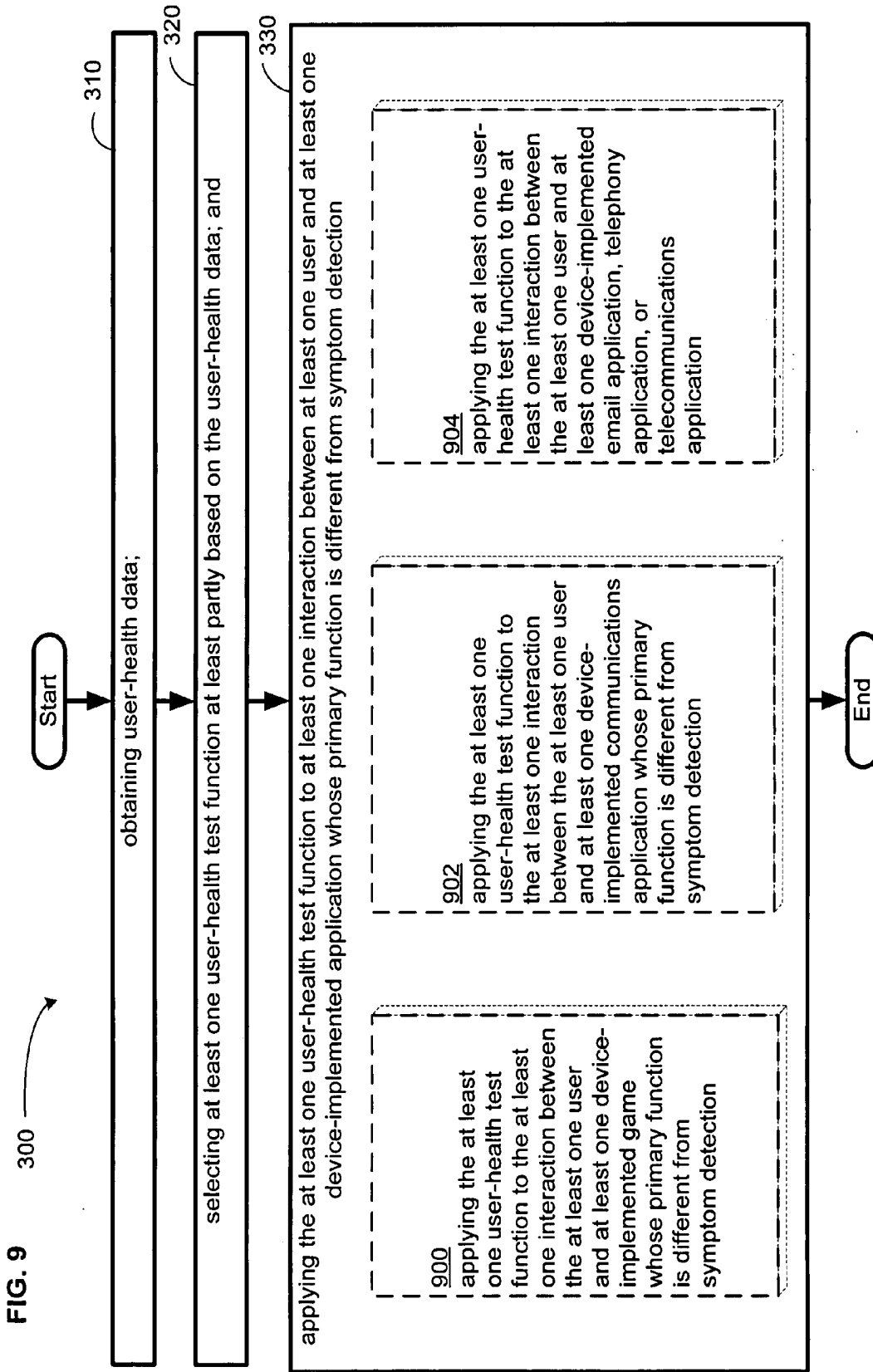


FIG. 7







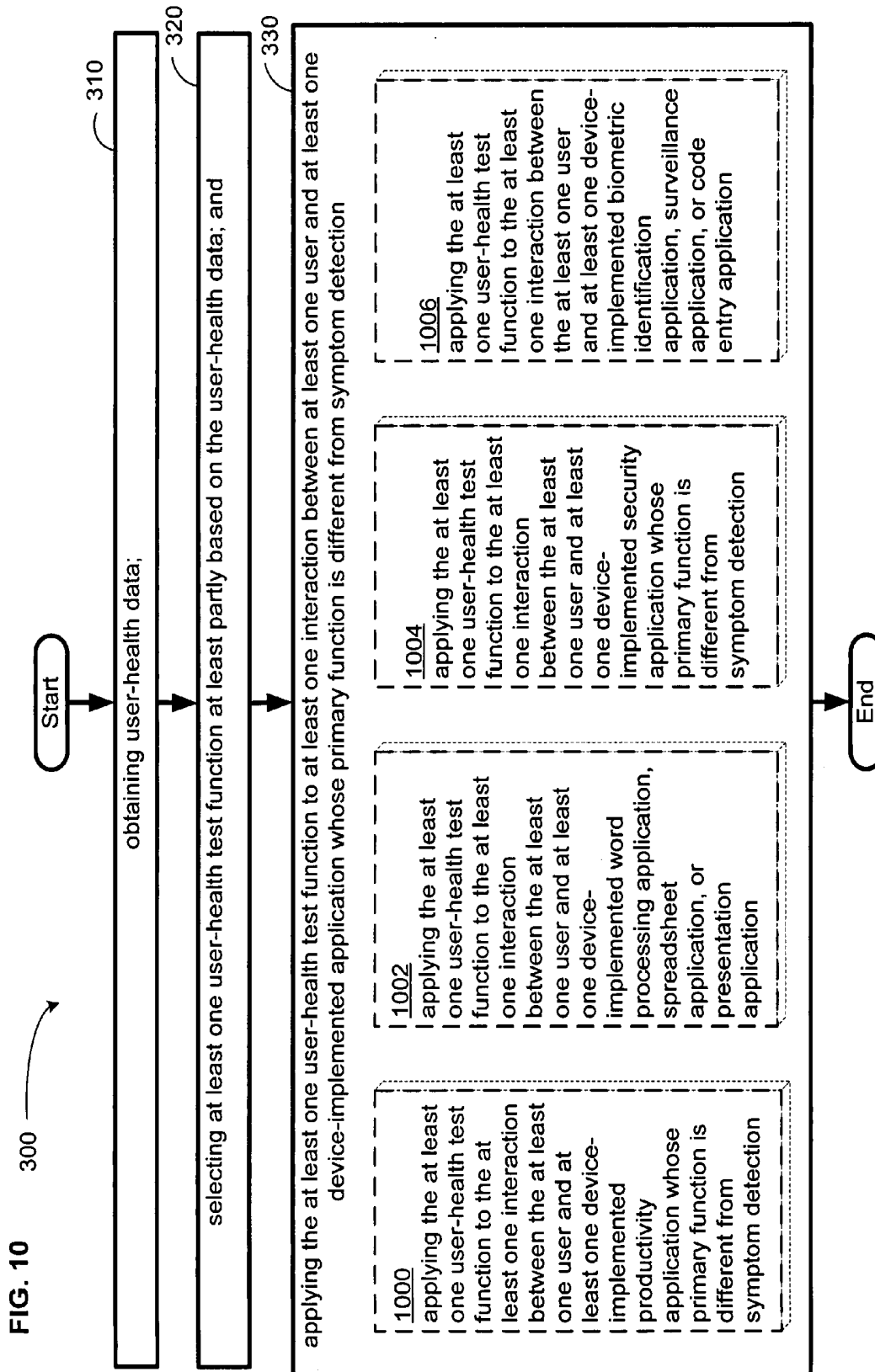


FIG. 11

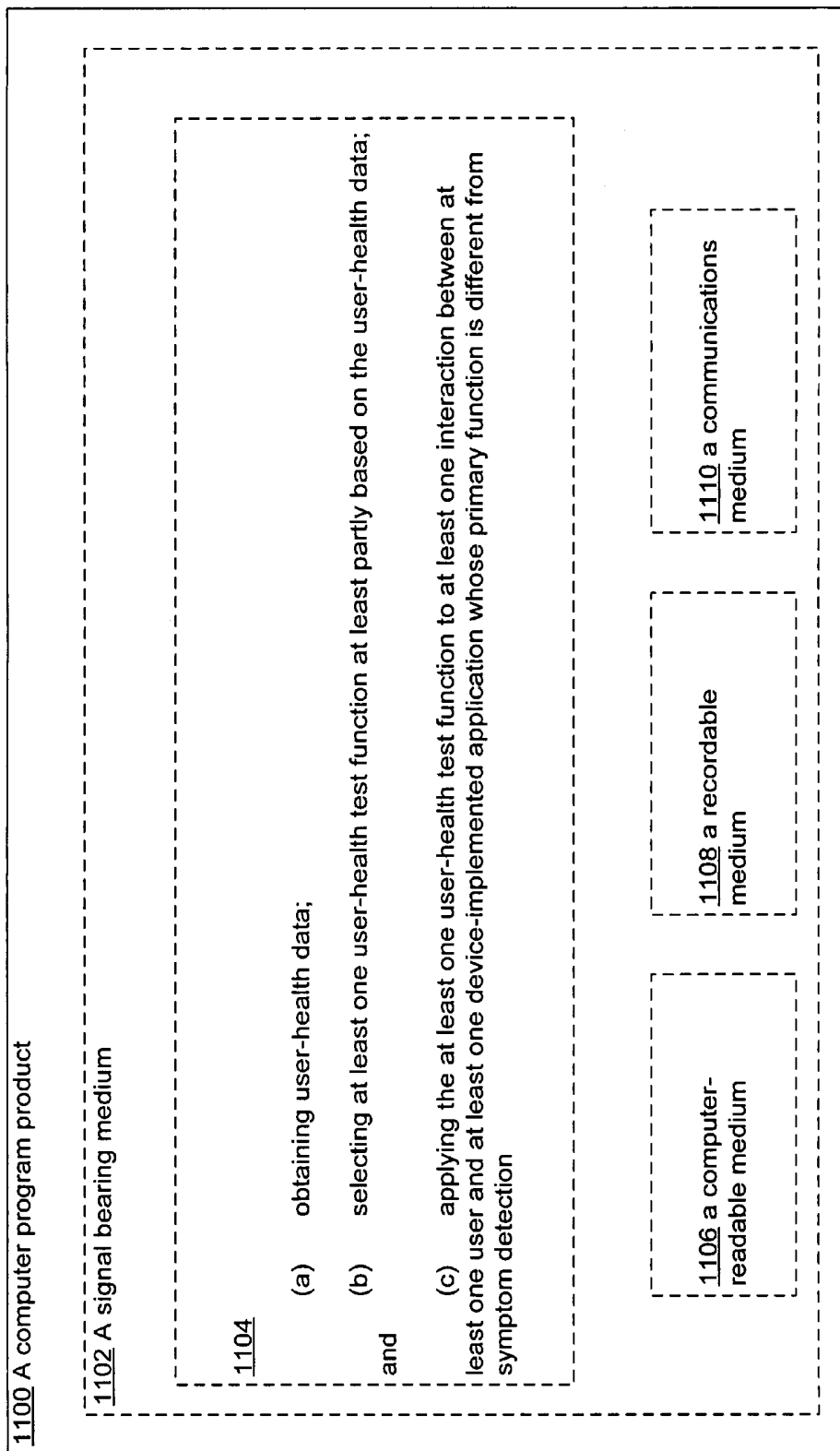
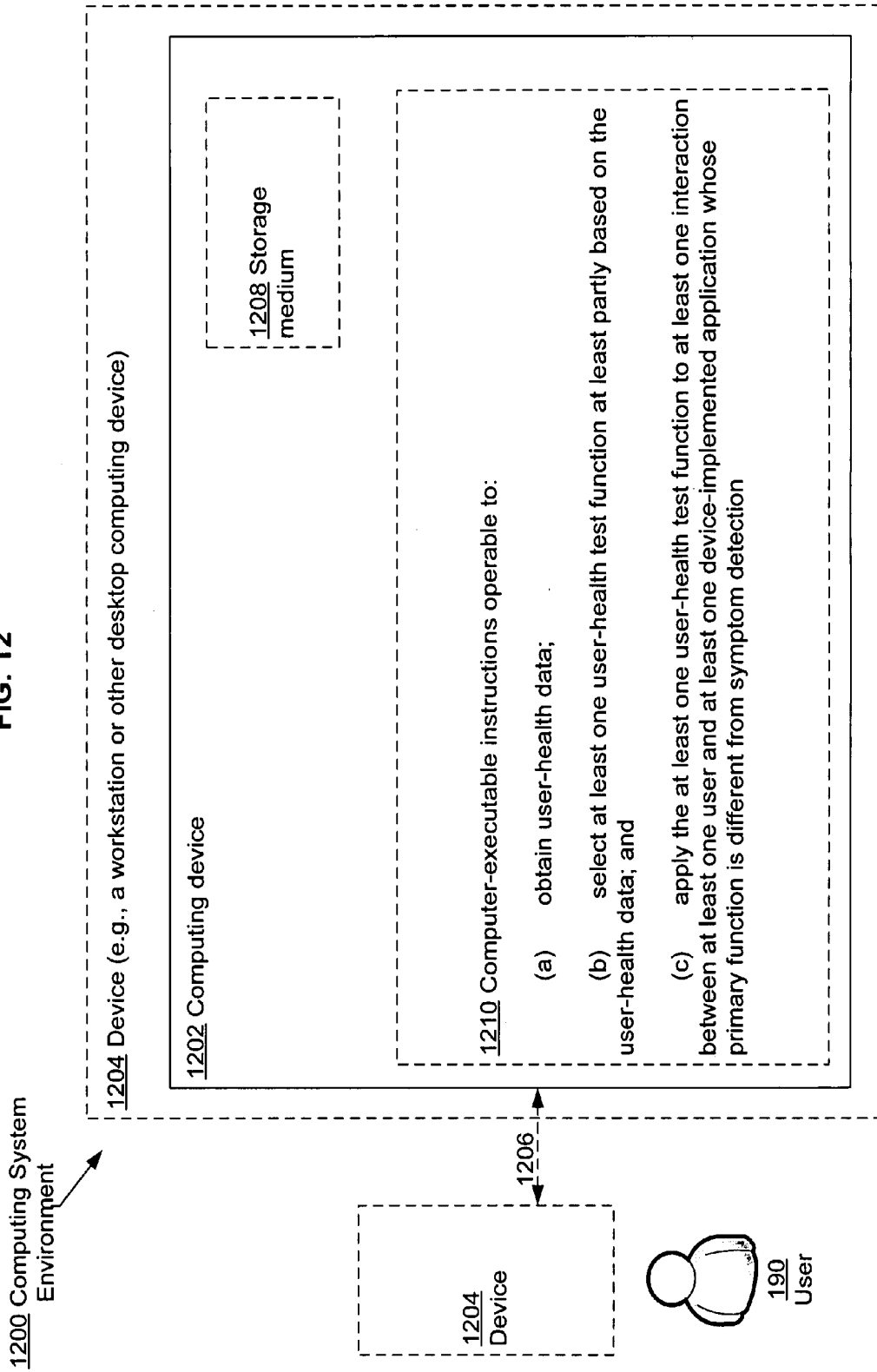


FIG. 12



COMPUTATIONAL USER-HEALTH TESTING**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] The present application is related to and claims the benefit of the earliest available effective filing date(s) from the following listed application(s) (the "Related Applications") (e.g., claims earliest available priority dates for other than provisional patent applications or claims benefits under 35 USC § 119(e) for provisional patent applications, for any and all parent, grandparent, great-grandparent, etc. applications of the Related Application(s)).

RELATED APPLICATIONS

[0002] For purposes of the USPTO extra-statutory requirements, the present application constitutes a continuation-in-part of U.S. application Ser. No. NOT YET ASSIGNED, entitled COMPUTATIONAL USER-HEALTH TESTING, naming Edward K. Y. Jung; Eric C. Leuthardt; Royce A. Levien; Robert W. Lord; and Mark A. Malamud as inventors, filed 24 May 2007 which is currently co-pending, or is an application of which a currently co-pending application is entitled to the benefit of the filing date.

[0003] For purposes of the USPTO extra-statutory requirements, the present application constitutes a continuation-in-part of U.S. patent application Ser. No. 11/804,304, entitled COMPUTATIONAL USER-HEALTH TESTING, naming Edward K. Y. Jung; Eric C. Leuthardt; Royce A. Levien; Robert W. Lord; and Mark A. Malamud as inventors, filed 15 May 2007 which is currently co-pending, or is an application of which a currently co-pending application is entitled to the benefit of the filing date.

[0004] For purposes of the USPTO extra-statutory requirements, the present application constitutes a continuation-in-part of U.S. patent application Ser. No. 11/731,745, entitled EFFECTIVE RESPONSE PROTOCOLS FOR HEALTH MONITORING OR THE LIKE, naming Edward K. Y. Jung; Eric C. Leuthardt; Royce A. Levien; Robert W. Lord; and Mark A. Malamud as inventors, filed 30 Mar. 2007 which is currently co-pending, or is an application of which a currently co-pending application is entitled to the benefit of the filing date.

[0005] For purposes of the USPTO extra-statutory requirements, the present application constitutes a continuation-in-part of U.S. patent application Ser. No. 11/731,778, entitled CONFIGURING SOFTWARE FOR EFFECTIVE HEALTH MONITORING OR THE LIKE, naming Edward K. Y. Jung; Eric C. Leuthardt; Royce A. Levien; Robert W. Lord; and Mark A. Malamud as inventors, filed 30 Mar. 2007 which is currently co-pending, or is an application of which a currently co-pending application is entitled to the benefit of the filing date.

[0006] For purposes of the USPTO extra-statutory requirements, the present application constitutes a continuation-in-part of U.S. patent application Ser. No. 11/731,801, entitled EFFECTIVE LOW PROFILE HEALTH MONITORING OR THE LIKE, naming Edward K. Y. Jung; Eric C. Leuthardt; Royce A. Levien; Robert W. Lord; and Mark A. Malamud as inventors,

filed 30 Mar. 2007 which is currently co-pending, or is an application of which a currently co-pending application is entitled to the benefit of the filing date.

[0007] The United States Patent Office (USPTO) has published a notice to the effect that the USPTO's computer programs require that patent applicants reference both a serial number and indicate whether an application is a continuation or continuation-in-part. Stephen G. Kunin, Benefit of Prior-Filed Application, USPTO Official Gazette Mar. 18, 2003, available at <http://www.uspto.gov/web/offices/com/sol/og/2003/week11/patbene.htm>. The present Applicant Entity (hereinafter "Applicant") has provided above a specific reference to the application(s) from which priority is being claimed as recited by statute. Applicant understands that the statute is unambiguous in its specific reference language and does not require either a serial number or any characterization, such as "continuation" or "continuation-in-part," for claiming priority to U.S. patent applications. Notwithstanding the foregoing, Applicant understands that the USPTO's computer programs have certain data entry requirements, and hence Applicant is designating the present application as a continuation-in-part of its parent applications as set forth above, but expressly points out that such designations are not to be construed in any way as any type of commentary and/or admission as to whether or not the present application contains any new matter in addition to the matter of its parent application(s).

[0008] All subject matter of the Related Applications and of any and all parent, grandparent, great-grandparent, etc. applications of the Related Applications is incorporated herein by reference to the extent such subject matter is not inconsistent herewith.

TECHNICAL FIELD

[0009] This description relates to data capture and data handling techniques.

SUMMARY

[0010] An embodiment provides a method. In one implementation, the method includes but is not limited to obtaining user-health data; selecting at least one user-health test function at least partly based on the user-health data; and applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection. In addition to the foregoing, other method aspects are described in the claims, drawings, and text forming a part of the present disclosure.

[0011] In one or more various aspects, related systems include but are not limited to circuitry and/or programming for effecting the herein-referenced method aspects; the circuitry and/or programming can be virtually any combination of hardware, software, and/or firmware configured to effect the herein-referenced method aspects depending upon the design choices of the system designer.

[0012] An embodiment provides a computer program product. In one implementation, the computer program product includes but is not limited to a signal-bearing medium bearing (a) one or more instructions for obtaining user-health data; (b) one or more instructions for selecting at least one user-health test function at least partly based on the user-health data; and (c) one or more instructions for applying the at least one user-health test function to at least one interaction between at

least one user and at least one device-implemented application whose primary function is different from symptom detection. In addition to the foregoing, other computer program product aspects are described in the claims, drawings, and text forming a part of the present disclosure.

[0013] An embodiment provides a system. In one implementation, the system includes but is not limited to a computing device and instructions. The instructions when executed on the computing device cause the computing device to (a) obtain user-health data; (b) select at least one user-health test function at least partly based on the user-health data; and (c) apply the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection. In addition to the foregoing, other system aspects are described in the claims, drawings, and text forming a part of the present disclosure.

[0014] In one or more various aspects, related systems include but are not limited to computing means and/or programming for effecting the herein-referenced method aspects; the computing means and/or programming may be virtually any combination of hardware, software, and/or firmware configured to effect the herein-referenced method aspects depending upon the design choices of the system designer.

[0015] In addition to the foregoing, various other method and/or system and/or program product aspects are set forth and described in the teachings such as text (e.g., claims and/or detailed description) and/or drawings of the present disclosure.

[0016] The foregoing is a summary and thus contains, by necessity, simplifications, generalizations and omissions of detail; consequently, those skilled in the art will appreciate that the summary is illustrative only and is NOT intended to be in any way limiting. Other aspects, features, and advantages of the devices and/or processes and/or other subject matter described herein will become apparent in the teachings set forth herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] With reference now to FIG. 1, shown is an example of a user interaction and data processing system in which embodiments may be implemented, perhaps in a device, which may serve as a context for introducing one or more processes and/or devices described herein.

[0018] FIG. 2 illustrates certain alternative embodiments of the data capture and processing system of FIG. 1.

[0019] FIG. 3 illustrates certain alternative embodiments of the data capture and processing system of FIG. 1.

[0020] With reference now to FIG. 3, shown is an example of an operational flow representing example operations related to computational user-health testing, which may serve as a context for introducing one or more processes and/or devices described herein.

[0021] FIG. 4 illustrates an alternative embodiment of the example operational flow of FIG. 3.

[0022] FIG. 5 illustrates an alternative embodiment of the example operational flow of FIG. 3.

[0023] FIG. 7 illustrates an alternative embodiment of the example operational flow of FIG. 3.

[0024] FIG. 8 illustrates an alternative embodiment of the example operational flow of FIG. 3.

[0025] FIG. 9 illustrates an alternative embodiment of the example operational flow of FIG. 3.

[0026] FIG. 10 illustrates an alternative embodiment of the example operational flow of FIG. 3.

[0027] FIG. 11 illustrates an alternative embodiment of the example operational flow of FIG. 3.

[0028] With reference now to FIG. 12, shown is a partial view of an example computer program product that includes a computer program for executing a computer process on a computing device related to computational user-health testing, which may serve as a context for introducing one or more processes and/or devices described herein.

[0029] With reference now to FIG. 13, shown is an example device in which embodiments may be implemented related to computational user-health testing, which may serve as a context for introducing one or more processes and/or devices described herein.

[0030] The use of the same symbols in different drawings typically indicates similar or identical items.

DETAILED DESCRIPTION

[0031] FIG. 1 illustrates an example system 100 in which embodiments may be implemented. The system 100 includes at least one device 102. The at least one device 102 may contain, for example, an application 104 and a user-health test function unit 140. User-health test function unit 140 may generate user-health data 116, or user-health data 116 may be obtained from a user-health data module 150 that is external to the at least one device 102.

[0032] User-health test function unit 140 may include user health test function set 196, user health test function set 197, and/or user health test function set 198. The at least one device 102 may optionally include a data detection module 114, a data capture module 136, and/or a user-health test function selection module 138. The system 100 may also include a user input device 180, and/or a user monitoring device 182.

[0033] In some embodiments the user-health test function unit 140 and/or user-health test function selection module 138 may be located on an external device 194 that can communicate with the at least one device 102, on which the application 104 is operable, via network 192. In some embodiments, the application 104 may be located on an external device 194, and operable on the device 102 remotely via, for example, network 192.

[0034] In some embodiments, the user-health test function unit 140 may exist within the application 104. In other embodiments, the user-health test function unit 140 may be structurally distinct from the application 104.

[0035] In FIG. 1, the at least one device 102 is illustrated as possibly being included within a system 100. Of course, virtually any kind of computing device may be used in connection with the application 104, such as, for example, a workstation, a desktop computer, a mobile computer, a networked computer, a collection of servers and/or databases, cellular phone, personal entertainment device, or a tablet PC.

[0036] Additionally, not all of the application 104, user-health test function unit 140, and/or user-health test function selection module 138 need be implemented on a single computing device. For example, the application 104 may be implemented and/or operable on a remote computer, while the user interface 184 and/or user-health data 116 are implemented and/or stored on a local computer as the at least one device 102. Further, aspects of the application 104, user-

health test function unit **140** and/or user-health test function selection module **138** may be implemented in different combinations and implementations than that shown in FIG. 1. For example, functionality of the user interface **184** may be incorporated into the at least one device **102**. The at least one device **102**, user-health test function unit **140**, and/or user-health test function selection module **138** may perform simple data relay functions and/or complex data analysis, including, for example, fuzzy logic and/or traditional logic steps. Further, many methods of searching databases known in the art may be used, including, for example, unsupervised pattern discovery methods, coincidence detection methods, and/or entity relationship modeling. In some embodiments, the at least one device **102**, user-health test function unit **140**, and/or user-health test function selection module **138** may process user-health data **116** according to health profiles available as updates through a network.

[0037] The user-health data **116** may be stored in virtually any type of memory that is able to store and/or provide access to information in, for example, a one-to-many, many-to-one, and/or many-to-many relationship. Such a memory may include, for example, a relational database and/or an object-oriented database, examples of which are provided in more detail herein.

[0038] FIG. 2 illustrates certain alternative embodiments of the system **100** of FIG. 1. In FIG. 2, the user **190** may use the user interface **184** to interact through a network **202** with the application **104** operable on the at least one device **102**. A user-health test function unit **140** and/or user-health test function selection module **138** may be implemented on the at least one device **102**, or elsewhere within the system **100** but separate from the at least one device **102**. The at least one device **102** may be in communication over a network **202** with a network destination **206** and/or healthcare provider **210**, which may interact with the at least one device **102**, user-health test function unit **140**, and/or user-health test function selection module **138** through, for example, a user interface **208**. Of course, it should be understood that there may be many users other than the specifically-illustrated user **190**, for example, each with access to a local instance of the application **104**.

[0039] In this way, the user **190**, who may be using a device that is connected through a network **202** with the system **100** (e.g., in an office, outdoors and/or in a public environment), may generate user-health data **116** as if the user **190** were interacting locally with the at least one device **102** on which the application **104** is locally operable.

[0040] As referenced herein, the at least one device **102** and/or user-health test function selection module **138** may be used to perform various data querying and/or recall techniques with respect to the user-health data **116**, in order to select at least one user-health test function at least partly based on the user-health data **116**. For example, where the user-health data **116** is organized, keyed to, and/or otherwise accessible using one or more reference health condition attributes or profiles, various Boolean, statistical, and/or semi-boolean searching techniques may be performed to match user-health data **116** with reference health condition data, attributes, or profiles.

[0041] Many examples of databases and database structures may be used in connection with the at least one device **102**, user-health test function unit **140**, and/or user-health test function selection module **138**. Such examples include hierarchical models (in which data is organized in a tree and/or

parent-child node structure), network models (based on set theory, and in which multi-parent structures per child node are supported), or object/relational models (combining the relational model with the object-oriented model).

[0042] Still other examples include various types of eXtensible Mark-up Language (XML) databases. For example, a database may be included that holds data in some format other than XML, but that is associated with an XML interface for accessing the database using XML. As another example, a database may store XML data directly. Additionally, or alternatively, virtually any semi-structured database may be used, so that context may be provided to/associated with stored data elements (either encoded with the data elements, or encoded externally to the data elements), so that data storage and/or access may be facilitated.

[0043] Such databases, and/or other memory storage techniques, may be written and/or implemented using various programming or coding languages. For example, object-oriented database management systems may be written in programming languages such as, for example, C++ or Java. Relational and/or object/relational models may make use of database languages, such as, for example, the structured query language (SQL), which may be used, for example, for interactive queries for information and/or for gathering and/or compiling data from the relational database(s).

[0044] For example, SQL or SQL-like operations over one or more of reference health condition may be performed, or Boolean operations using a reference health condition may be performed. For example, weighted Boolean operations may be performed in which different weights or priorities are assigned to one or more of the reference health conditions, perhaps relative to one another. For example, a number-weighted, exclusive-OR operation may be performed to request specific weightings of desired (or undesired) health reference data to be included or excluded.

[0045] FIG. 3 illustrates an operational flow **300** representing example operations related to computational user-health testing. In FIG. 3 and in following figures that include various examples of operational flows, discussion and explanation may be provided with respect to the above-described system environments of FIGS. 1-2, and/or with respect to other examples and contexts. However, it should be understood that the operational flows may be executed in a number of other environments and contexts, and/or in modified versions of FIG. 12. Also, although the various operational flows are presented in the sequence(s) illustrated, it should be understood that the various operations may be performed in other orders than those which are illustrated, or may be performed concurrently.

[0046] After a start operation, operation **310** shows obtaining user-health data. User-health data **116** may be obtained by a device **102**, or by a data detection module **114**, or data capture module **136** resident on the device **102** or otherwise associated with system **100**. Alternatively, user-health data **116** may be obtained via a user input device **180** and/or user monitoring device **182** associated with the at least one device **102** and/or system **100**. Alternatively user-health data **116** may be obtained from a user medical record **152**, perhaps contained within a user-health data module **150** or resident on a remote database. Alternatively, user-health data **116** may be obtained as output from a user-health test function **130** operable on the device **102** locally or via a network **192**. In one embodiment, the user-health data **116** may be obtained from a different system than system **100**.

[0047] User-health data 116 may include various types of user-health data, including but not limited to user health attribute data, user health measurement data, user health testing data, and/or user-health test function output data. For example, a user 190 with a particular health concern may input information about the health concern in the form of affected body systems such as visual or motor systems. Alternatively, a user 190 may input information about specific health measurements, such as reaction time, typing rate, visual field, cognitive impairment, or the like. Alternatively, a user 190 may input results of traditional health testing such as heart rate, blood oxygen level, or motor skill function as determined by, for example, a health care provider 210.

[0048] In another embodiment, the system 100 and/or device 102 may obtain user-health test function output data as user-health data 116. Such user-health test function output data may be obtained from a process that is internal to the system 100 or device 102, or obtained from a process that is external to the system 100 or device 102. One example of user-health test function output data is user-health data 116 obtained from a user-health test function 130 applied to an interaction between a user 190 and a device-implemented application whose primary function is different from symptom detection, as described herein.

[0049] Operation 320 depicts selecting at least one user-health test function at least partly based on the user-health data. For example, a user-health test function unit 140 of the at least one device 102, or associated with the at least one device 102, may map user-health data 116 obtained by the device 102, for example, to at least one user-health test function set 196, user-health test function set 197, and/or user-health test function set 198. For example, the user-health test function unit 140 may map user reaction time data to a user-health test function set 198 that can make use of the reaction time data. An alertness test function and/or an attention test function may be contained within a specific user-health test function set 198, including various alertness or attention test functions described below, such as a reaction time test function and/or a test of a user's ability to say a series of numbers forward and backwards. In one embodiment, the user-health test function selection module 138 may select a specific user-health test function at least partly based on an output of another user-health test function. For example, the device 102 may obtain an indication of decreased alertness in a user 190 in the form of output from a reaction time test function. The user-health test function selection module 138 may then select another alertness test function, for example, a naming test function, based on the output from the reaction time test function.

[0050] Alternatively, user-health test function selection may be carried out based on a best-fit analysis of the user-health test function output data together with potential subsequent user-health test functions. Various best-fit analysis methods are known in the art and can be employed or adapted by one of skill in the art (see, for example, Zhou G., U.S. Pat. No. 6,999,931 "Spoken dialog system using a best-fit language model and best-fit grammar").

[0051] Operation 330 depicts applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection. In one embodiment, for example, the at least one device 102 and/or user-health test function selection module 138 may select a particular user-health test function 130 such as a

pointing device manipulation test function, for example, based on user-health data 116 indicating Parkinson's disease as a user health attribute. The selected pointing device manipulation test function may then be applied to an interaction between the user 190 and a game operable on the device 102, for example.

[0052] Another example of applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection is applying a selected hearing test function to an interaction between a user and a music-playing device, video-playing device, or other personal entertainment device that emits sound. In this case, the device-implemented application can be a media player for playing music or movies, or the like. Similarly, a selected vision test function may be applied by the at least one device 102 to an interaction between a user and a media player application that, for example, displays a photograph or movie on a computer screen or other monitoring device.

[0053] System 100 and/or the at least one device 102 may include an application 104 that is operable on the at least one device 102, to perform a primary function that is different from symptom detection. For example, an online computer game may be operable as an application 104 on a personal computing device through a network 192. Thus the at least one application 104 may reside on the at least one device 102, or the at least one application 104 may not reside on the at least one device 102 but instead be operable on the at least one device 102 from a remote location, for example, through a network or other link.

[0054] User-health data signals may first be encoded and/or represented in digital form (i.e., as digital data), prior to the assignment to at least one memory. For example, a digitally-encoded representation of user eye movement data may be stored in a local memory, or may be transmitted for storage in a remote memory.

[0055] Thus, an operation may be performed relating either to a local or remote storage of the digital data, or to another type of transmission of the digital data. Operations also may be performed relating to accessing, querying, processing, recalling, or otherwise obtaining the digital data from a memory, including, for example, receiving a transmission of the digital data from a remote memory. Accordingly, such operation(s) may involve elements including at least an operator (e.g., either human or computer) directing the operation, a transmitting computer, and/or a receiving computer, and should be understood to occur within the United States as long as at least one of these elements resides in the United States.

[0056] FIG. 4 illustrates alternative embodiments of the example operational flow 300 of FIG. 3. FIG. 4 illustrates example embodiments where the obtaining operation 310 may include at least one additional operation. Additional operations may include operation 400, 402, 404, 406, 408, 410, 412, 414, and/or operation 416.

[0057] Operation 400 depicts obtaining user health attribute data. For example, the at least one device 102, data detection module 114, and/or data capture module 136 may obtain user-health data 116 of a certain type, for example, user health attribute data. For example, user health attribute data may be obtained via user input of health attributes such as mental state, mood, physical discomfort, or the like.

[0058] Operation **402** depicts obtaining user health condition data or user symptom data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user-health data **116** of a certain type, for example, user health condition data or user symptom data. For example, user health condition data may be obtained via a medical database query of a user's medical records for relevant medical conditions such as Parkinson's disease, dementia, insomnia, or the like. Alternatively, a health care provider **210** may input one or more symptoms as the user symptom data, such as memory loss, tremor, reduced visual field, or the like.

[0059] Operation **404** depicts obtaining user medication data or user nutraceutical data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user-health data **116** of a certain type, for example, user medication data or user nutraceutical data. For example, user medication data may be obtained via a medical database query of a user's medical records for relevant medications such as an anti-dementia drug, sleeping pill, glaucoma drops, or the like. Alternatively, a user **190** may input one or more nutraceuticals as the user nutraceutical data, such as phosphatidylserine, Ginkgo biloba, caffeine, ginseng, or the like.

[0060] Operation **406** depicts obtaining user health measurement data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user health measurement data of a certain type, for example, user tremor data acquired by a camera set up to monitor the user during interaction with, for example, a game **106** that is operable on the at least one device **102**. Another example of user health measurement data is flushing, blushing, or other skin color change in the user that can be detected by, for example, a camera. Another example of user health measurement data is stuttering or other speech attribute during a user's vocal interaction with an application operable on the device **102**, for example a speech recognition program having a primary function of accepting language input from a user **190**.

[0061] Operation **408** depicts obtaining user cardiovascular measurement data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user cardiovascular measurement data, for example, from a pulse meter, heart rate monitor, blood pressure monitor, or the like.

[0062] Operation **410** depicts obtaining user respiratory measurement data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user respiratory measurement data, for example, from a pulse oximeter, respiration monitor, or the like.

[0063] Operation **412** depicts obtaining user health testing data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user health testing data from a device, database, file, or user input. For example, a user may configure a device **102** to receive user blood pressure data, for example, from an electronic blood pressure monitor. Alternatively, the system **100** and/or device **102** may obtain user blood pressure data from a medical history database and/or from a locally stored health file kept, for example, by the user **190** or a health care provider **210**. Alternatively, the user **190** or health care provider **210** may input user blood pressure data directly into the device **102** and/or system **100**.

[0064] Operation **414** depicts obtaining user mental health testing data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user mental health testing data from a device, database, file, user input, or the like. For example, user mental health testing data from a depression test, a mania test, a personality test, an anxiety test, or the like may be obtained from records available to or accessible by system **100** and/or device **102**. Such mental health testing data may also be entered into the system **100** and/or device **102** by the user **100** and/or the health care provider **210**.

[0065] Operation **416** depicts obtaining user physical health testing data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user physical health testing data from a device, database, file, user input, or the like. For example, a user **190** may undertake a visual field test, for example, on a personal computer so as to obtain visual field test data. Such visual field tests or campimeters are available online (e.g., at http://www.testvision.org/what_is.htm). Thus, a user **190** may generate physical health testing data on a device **102**. Alternatively, such user physical health testing data may be obtained from a health care provider **210**, user input, or any health file accessible by the system **100** and/or device **102**. Alternatively, physical health testing data may be obtained by the system **100** and/or device **102** from a device, such as an electrocardiograph (EKG), electroencephalograph (EEG), respiration monitor, blood pressure monitor, or the like.

[0066] FIG. **5** illustrates alternative embodiments of the example operational flow **300** of FIG. **3**. FIG. **5** illustrates example embodiments where the obtaining operation **310** may include at least one additional operation. Additional operations may include operation **500**, **502**, **504**, and/or operation **506**.

[0067] Operation **500** depicts obtaining user-health test function output data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user-health test function output data. As an example, the at least one device **102** may include a user-health test function that operates to analyze user data from an interaction between the user **190** and an application **104** operable on the device **102**. Such analysis by the user-health test function may result in output that signals a change in a user-health attribute, for example, memory, reaction time, motor skill, mood, or the like. This is one example of the system **100** and/or device **102** obtaining user-health test function output data. In one embodiment, for example, the at least one device **102** may obtain user-health test function output data from a source outside the system **100**, or stored on a memory within system **100** and/or device **102**.

[0068] Operation **502** depicts obtaining mental status test function output data. For example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user speech function output data, for example, based on an interaction between a user **190** and a speech recognition application operable on the device **102** wherein the user **190** exhibits an altered rate of spontaneous speech. Alternatively, for example, the at least one device **102**, data detection module **114**, and/or data capture module **136** may obtain user hearing test function output data from a user speech test function measuring an interaction between the user **190** and a mobile telephone or videoconferencing application by determining the phrase length, rate of speech, abundance of speech, or the like. Other mental status test function

outputs include altered reaction time, altered attention, altered memory, altered comprehension ability, altered reading ability, altered calculation ability, an altered neglect attribute, altered construction ability, altered task sequencing ability, or the like.

[0069] Operation 504 depicts obtaining cranial nerve test function output data. For example, the at least one device 102, data detection module 114, and/or data capture module 136 may obtain user hearing test function output data, for example, based on an interaction between a user 190 and a music-playing application operable on the device 102 wherein the user 190 exhibits an altered ability to hear, for example, a sounds below a certain frequency or volume. Alternatively, for example, the at least one device 102, data detection module 114, and/or data capture module 136 may obtain user hearing test function output data from a user hearing test function measuring an interaction between the user 190 and a mobile telephone by determining a volume setting on the telephone and/or changes to the volume setting.

[0070] As another example, the at least one device 102, data detection module 114, and/or data capture module 136 may obtain user pupil movement test function output data, for example, based on a user's interaction with a videoconferencing application operable on the at least one device 102.

In a further example, the at least one device 102, data capture module 136, and/or user monitoring device 182 may obtain user face movement test function output data based on an interaction between the user 190 and a videoconferencing application, for example, where the user face movement test function detects an alteration in flushing, blushing, or other skin color change in the user's face, which can be detected by, for example, a camera.

[0071] Operation 506 depicts obtaining cerebellum test function output data. For example, the at least one device 102, data detection module 114, and/or data capture module 136 may obtain user body movement function output data based on an interaction between the user 190 and a game involving user motion, for example, swinging a bat in a virtual baseball game wherein user body movement data is detectable through, for example, a haptic feedback device, a camera recording user body movements, an accelerometer, or the like.

[0072] FIG. 6 illustrates alternative embodiments of the example operational flow 300 of FIG. 3. FIG. 6 illustrates example embodiments where the obtaining operation 310 may include at least one additional operation. Additional operations may include operation 600, 602, 604, and/or operation 606.

[0073] Operation 600 depicts obtaining user-health test function output data. For example, the at least one device 102, data detection module 114, and/or data capture module 136 may obtain user-health test function output data. As an example, the at least one device 102 may include a user-health test function that operates to analyze user data from an interaction between the user 190 and an application 104 operable on the device 102. Such analysis by the user-health test function may result in output that signals a change in a user-health attribute, for example, memory, reaction time, hearing, body movement, motor skill, mood, or the like. This is one example of the system 100 and/or device 102 obtaining user-health test function output data. In one embodiment, for example, the at least one device 102 may obtain user-health test function output data from a source outside the system 100, or stored on a memory within system 100 and/or device 102.

[0074] Operation 602 depicts obtaining alertness test function output data, attention test function output data, memory test function output data, speech test function output data, calculation test function output data, neglect test function output data, construction test function output data, or task sequencing test function output data. For example, the at least one device 102, data detection module 114, user input device 180, and/or data capture module 136 may obtain alertness test function output data from an alertness test function based on user keystroke data during an interaction between the user 190 and a word processing program on a desktop computer, or between the user 190 and an email program on a handheld device.

[0075] Alternatively, for example, the at least one device 102, data detection module 114, user input device 180, and/or data capture module 136 may obtain user task sequencing test function output data from a task sequencing test function measuring keystroke data during an interaction between the user 190 and a telephony application on a mobile telephone. In this example, alertness test function output data may include an altered ability to navigate an automated menu in the correct sequence, or an altered ability to input a response to a prompt within a time interval, as measured by keystroke input, voice input, or the like.

[0076] Operation 604 depicts obtaining visual field test function output data, eye movement test function output data, pupil movement test function output data, face pattern test function output data, hearing test function output data, or voice test function output data. For example, the at least one device 102, data detection module 114, user input device 180, and/or data capture module 136 may obtain visual field test function output data from an visual field test function based on user pointing device manipulation data during an interaction between the user 190 and a game 106 that involves mouse, trackball, touchscreen, stylus movement, joystick, or the like.

[0077] Alternatively, for example, the at least one device 102, data detection module 114, user input device 180, and/or data capture module 136 may obtain pupil movement test function output data from a pupil movement test function based on passive user data from, for example, a user's interaction with a security application including a camera recording images of the user's eye.

[0078] Operation 606 depicts obtaining body movement test function output data or motor skill test function output data. For example, the at least one device 102, data detection module 114, user input device 180, and/or data capture module 136 may obtain user-health data 116 from an interaction between the user 190 and at least one puzzle game operable on the at least one device. Such a game 106 may generate user-health data 116 via a user input device 180 and/or user monitoring device 182. Examples of a user input device 180 include a text entry device such as a keyboard, a pointing device such as a mouse, a touchscreen, joystick, or the like. Examples of a user monitoring device 182 include a microphone, a photography device, a video device, or the like.

[0079] Examples of a game 106 may include a computer game such as, for example, solitaire, puzzle games, role-playing games, first-person shooting games, strategy games, sports games, racing games, adventure games, or the like. Such games may be played offline or through a network (e.g., online games). Other examples of a game 106 include games involving physical gestures, and interactive games.

[0080] FIG. 7 illustrates alternative embodiments of the example operational flow 300 of FIG. 3. FIG. 7 illustrates example embodiments where the selecting operation 320 may include at least one additional operation. Additional operations may include operation 700, 702, 704, 706, 708, and/or operation 710.

[0081] Operation 700 depicts selecting at least one mental status test function. For example, a user-health test function selection module 138 may select a mental status test function based on user-health data, for example, mental status test function output data provided by a user-health test function unit 140.

[0082] Selecting at least one mental status test function may be done based on any obtained user-health data, as described above. In general, obtaining user-health data of a certain type may trigger selection of at least one user-health test function that relates to the user-health data. For example, user-health data obtained in the form of altered user reaction time data may trigger the selection of one or more additional test functions related to mental status.

[0083] Alternatively, for example, user-health data in the form of a user's medical history may trigger the selection of a related mental status test function. For example, obtaining user-health data indicating Alzheimer's disease symptoms or diagnosis may result in the selection of a related mental status test function, such as a short-term memory test function or a long-term memory test function. Selection algorithms may be applied by one of skill in the art according to user-health data and related known user-health test functions, and those disclosed herein.

[0084] A mental status test function may include, for example, one or more alertness or attention test functions, one or more memory test functions, one or more speech test functions, one or more calculation test functions, one or more neglect or construction test functions, and/or one or more sequencing task test functions.

[0085] Operation 702 depicts selecting at least one cranial nerve test function. For example, a user-health test function selection module 138 may select a cranial nerve test function based on user-health data, for example, cranial nerve test function output data provided by a user-health test function unit 140.

[0086] Selecting at least one cranial nerve test function may be done based on any obtained user-health data, as described above. In general, obtaining user-health data of a certain type may trigger selection of at least one user-health test function that relates to the user-health data. For example, user-health data obtained in the form of altered user hearing data may trigger the selection of one or more cranial nerve test functions related to user hearing.

[0087] Alternatively, for example, user-health data in the form of a user's medical history may trigger the selection of a related cranial nerve test function. For example, obtaining user-health data indicating Bell's palsy symptoms or diagnosis may result in the selection of a related cranial nerve test function, such as a face pattern test function or a speech test function. Selection algorithms may be applied by one of skill in the art according to user-health data and related known user-health test functions, and those disclosed herein.

[0088] A cranial nerve test function may include, for example, one or more visual field test functions, one or more eye movement test functions, one or more pupil movement test

functions, one or more face pattern test functions, one or more hearing test functions, and/or one or more voice test functions.

[0089] Operation 704 depicts selecting at least one cerebellum test function. For example, a user-health test function selection module 138 may select a cerebellum test function based on user-health data, for example, cerebellum test function output data provided by a user-health test function unit 140.

[0090] Selecting at least one cerebellum test function may be done based on any obtained user-health data, as described above. In general, obtaining user-health data of a certain type may trigger selection of at least one user-health test function that relates to the user-health data. For example, user-health data obtained in the form of altered user body movement data may trigger the selection of one or more cerebellum test functions related to user motor skill, gait, and/or coordination.

[0091] Alternatively, for example, user-health data in the form of a user's medical history may trigger the selection of a related cerebellum test function. For example, obtaining user-health data indicating ataxia symptoms or diagnosis may result in the selection of a related cerebellum test function, such as a pointing device manipulation test function and/or an overshoot/past pointing test function. Selection algorithms may be applied by one of skill in the art according to user-health data and related known user-health test functions, and those disclosed herein.

[0092] A cerebellum test function may include, for example, one or more body movement test functions and/or one or more motor skill test functions.

[0093] Operation 706 depicts selecting at least one of an alertness test function, an attention test function, a memory test function, a speech test function, a calculation test function, a neglect test function, a construction test function, or a task sequencing test function. For example, a user-health test function selection module 138 may select an attention test function based on user-health data, for example, mental status test function output data provided by a user-health test function unit 140.

[0094] Selecting at least one of an alertness test function, an attention test function, a memory test function, a speech test function, a calculation test function, a neglect test function, a construction test function, or a task sequencing test function may be done based on any obtained user-health data, as described above. In general, obtaining user-health data of a certain type may trigger selection of at least one user-health test function that relates to the user-health data. For example, user-health data obtained in the form of altered user memory data may trigger the selection of one or more additional memory test functions in order to track memory function over time, or to examine different aspect of user memory function.

[0095] Alternatively, for example, user-health data in the form of a user's medical history may trigger the selection of related test functions. For example, obtaining from a medical records database user speech data indicating stroke symptoms or diagnosis may result in the selection of a related mental status test function, such as a comprehension test function and/or a naming test function. Selection algorithms may be applied by one of skill in the art according to user-health data and related known user-health test functions, and those disclosed herein.

[0096] An alertness test function or an attention test function set may include, for example, one or more reaction time test function, one or more spelling test function, and/or one or more speech test function.

[0097] Alertness or attention user attributes are indicators of a user's mental status. An example of an alertness test function may be a measure of reaction time as one objective manifestation. Examples of attention test functions may include ability to focus on simple tasks, ability to spell the word "world" forward and backward, or reciting a numerical sequence forward and backward as objective manifestations of an alertness problem. An alertness test function and/or user-health test unit **104** may require a user to enter a password backward as a measure of alertness. Alternatively, a user may be prompted to perform an executive function as a predicate to launching an application such as a word processing program. For example, an attention test function could be activated by a user command to open a word processing program, requiring performance of, for example, a spelling task as a preliminary step in launching the word processing program. Also, writing ability may be tested by requiring the user **190** to write their name or write a sentence on a device, perhaps with a stylus on a touchscreen.

[0098] Reduced level of alertness or attention can indicate the following possible conditions where an acute reduction in alertness or attention is detected: stroke involving the reticular activating system, stroke involving the bilateral or unilateral thalamus, metabolic abnormalities such as hyper or hypoglycemia, toxic effects due to substance overdose (for example, benzodiazepines, or other toxins such as alcohol). Reduced level of alertness and attention can indicate the following possible conditions where a subacute or chronic reduction in alertness or attention is detected: dementia (caused by, for example, Alzheimer's disease, vascular dementia, Parkinson's disease, Huntingdon's disease, Creutzfeldt-Jakob disease, Pick disease, head injury, infection, normal pressure hydrocephalus, brain tumor, exposure to toxin (for example, lead or other heavy metals), metabolic disorders, hormone disorders, hypoxia, drug reactions, drug overdose, drug abuse, encephalitis (caused by, for example, enteroviruses, herpes viruses, or arboviruses), or mood disorders (for example, bipolar disorder, cyclothymic disorder, depression, depressive disorder NOS (not otherwise specified), dysthymic disorder, postpartum depression, or seasonal affective disorder)).

[0099] In the context of the above alertness test function or attention test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. 4-6 and their supporting text. A reduced level of alertness or attention may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered alertness or attention associated with a likely condition. Test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed.,

McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0100] As another example, a user-health test function selection module **138** may select a memory test function based on user-health data, for example, mental status test function output data provided by a user-health test function unit **140**.

[0101] A memory test function may include, for example, one or more word list memory test functions, one or more number memory test functions, and/or one or more personal history memory test functions. Another example of a memory test function may include a text or number input device, or user monitoring device prompting a user **190** to, for example, spell, write, speak, or calculate in order to test, for example, short-term memory, long-term memory, or the like.

[0102] A user's memory attributes are indicators of a user's mental status. An example of a memory test function may be a measure of a user's short-term ability to recall items presented, for example, in a story, or after a short period of time. Another example of a memory test function may be a measure of a user's long-term memory, for example their ability to remember basic personal information such as birthdays, place of birth, or names of relatives. A memory test function may prompt a user **190** to change and enter a password with a specified frequency during internet browser use. A memory test function involving changes to a password that is required to access an internet server can challenge a user's memory according to a fixed or variable schedule.

[0103] Difficulty with recall after about 1 to 5 minutes may indicate damage to the limbic memory structures located in the medial temporal lobes and medial diencephalon of the brain, or damage to the fornix. Dysfunction of these structures characteristically causes anterograde amnesia, meaning difficulty remembering new facts and events occurring after lesion onset. Reduced short-term memory function can also indicate the following conditions: head injury, Alzheimer's disease, Herpes virus infection, seizure, emotional shock or hysteria, alcohol-related brain damage, barbiturate or heroin use, general anaesthetic effects, electroconvulsive therapy effects, stroke, transient ischemic attack (i.e., a "mini-stroke"), complication of brain surgery. Reduced long-term memory function can indicate the following conditions: Alzheimer's disease, alcohol-related brain damage, complication of brain surgery, depressive pseudodementia, adverse drug reactions (e.g., to benzodiazepines, anti-ulcer drugs, analgesics, anti-hypertensives, diabetes drugs, beta-blockers, anti Parkinson's disease drugs, anti-emetics, anti-psychotics, or certain drug combinations, such as haloperidol and methyldopa combination therapy), multi-infarct dementia, or head injury.

[0104] In the context of the above memory test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. 4-6 and their supporting text. Altered memory attributes may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered memory associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An

example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0105] A speech test function may include, for example, one or more speech test functions, one more comprehension test functions, one or more naming test functions, and/or one or more reading test functions.

[0106] User speech attributes are indicators of a user's mental status. An example of a speech test function may be a measure of a user's fluency or ability to produce spontaneous speech, including phrase length, rate of speech, abundance of spontaneous speech, tonal modulation, or whether paraphasic errors (e.g., inappropriately substituted words or syllables), neologisms (e.g., nonexistent words), or errors in grammar are present. Another example of a speech test function is a program that can measure the number of words spoken by a user during a video conference. The number of words per interaction or per unit time could be measured. A marked decrease in the number of words spoken could indicate a speech problem.

[0107] Another example of a voice or speech test function may include tracking of speech or voice data into a device or user monitoring device, such as a telephonic device or a video communication device with sound receiving/transmission capability, for example when a user task requires, for example, speaking, singing, or other vocalization.

[0108] Another example of a speech test function may be a measure of a user's comprehension of spoken language, including whether a user **190** can understand simple questions and commands, or grammatical structure. For example, a user-health test function may include a speech or voice analysis module **256** that may ask the user **190** the question "Mike was shot by John. Is John dead?" An inappropriate response may indicate a speech center defect. Alternatively a speech function test may require a user to say a code or phrase and repeat it several times. Speech defects may become apparent if the user has difficulty repeating the code or phrase during, for example, a videoconference setup or while using speech recognition software.

[0109] Another example of a speech test function may be a measure of a user's ability to name simple everyday objects (e.g., pen, watch, tie) and also more difficult objects (e.g., fingernail, belt buckle, stethoscope). A speech test function may, for example, require the naming of an object prior to or during the interaction of a user **190** with an application **104**, as a time-based or event-based checkpoint. For example, a user **190** may be prompted by a speech test function to say "armadillo" after being shown a picture of an armadillo, prior to or during the user's interaction with, for example, a word processing or email program. A test requiring the naming of parts of objects is often more difficult for users with speech comprehension impairment. Another speech test function may, for example, gauge a user's ability to repeat single words and sentences (e.g., "no if's and's or but's"). A further example of a speech test function measures a user's ability to read single

words, a brief written passage, or the front page of the newspaper aloud followed by a test for comprehension.

[0110] Difficulty with speech or reading/writing ability may indicate, for example, lesions in the dominant (usually left) frontal lobe, including Broca's area (output area); the left temporal and parietal lobes, including Wernicke's area (input area); subcortical white matter and gray matter structures, including thalamus and caudate nucleus; as well as the non-dominant hemisphere. Typical diagnostic conditions may include, for example, stroke, head trauma, dementia, multiple sclerosis, Parkinson's disease, or Landau-Kleffner syndrome (a rare syndrome of acquired epileptic aphasia).

[0111] In the context of the above speech test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. **4-6** and their supporting text. Altered speech attributes may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered speech associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0112] A calculation test function may include, for example, one or more arithmetic test functions involving a user's ability to perform simple math tasks. A user's calculation abilities are indicators of a user's mental status. An example of a calculation test function may be a measure of a user's ability to do simple math such as addition or subtraction, for example. A user **190** may be prompted to solve an arithmetic problem in the context of interacting with application **104**, or alternatively, in the context of using the at least one device **102** in between periods of interacting with the application **104**. For example, a user may be prompted to calculate the number of items and/or gold pieces collected during a segment of gameplay in the context of playing a game. In this and other contexts, user interaction with a device's operating system or other system functions may also constitute user interaction with an application **104**. Difficulty in completing calculation tests may be indicative of stroke (e.g., embolic, thrombotic, or due to vasculitis), dominant parietal lesion, or brain tumor (e.g., glioma or meningioma). When a calculation ability deficiency is found with defects in user ability to distinguish right and left body parts (right-left confusion), ability to name and identify each finger (finger agnosia), and ability to write their name and a sentence (agraphia), Gerstmann syndrome, a lesion in the dominant parietal lobe of the brain, may be present.

[0113] In the context of the above calculation test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. **4-6** and their supporting text. Altered calculation

ability may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered calculation ability associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0114] A neglect test function or a construction test function may include, for example, one or more body movement test functions, one or more pointing device manipulation test functions, and/or one or more cognitive test functions such as drawing test functions.

[0115] Neglect or construction user attributes are indicators of a user's mental status. Neglect may include a neurological condition involving a deficit in attention to an area of space, often one side of the body or the other. A construction defect may include a deficit in a user's ability to draw complex figures or manipulate blocks or other objects in space as a result of neglect or other visuospatial impairment.

[0116] Hemineglect may include an abnormality in attention to one side of the universe that is not due to a primary sensory or motor disturbance. In sensory neglect, users ignore visual, somatosensory, or auditory stimuli on the affected side, despite intact primary sensation. This can often be demonstrated by testing for extinction on double simultaneous stimulation. Thus, a neglect or construction test function set may contain user-health test functions that present a stimulus on one or both sides of a display for a user **190** to click on or otherwise recognize. A user **190** with hemineglect may detect the stimulus on the affected side when presented alone, but when stimuli are presented simultaneously on both sides, only the stimulus on the unaffected side may be detected. In motor neglect, normal strength may be present, however, the user often does not move the affected limb unless attention is strongly directed toward it.

[0117] An example of a neglect test function may be a measure of a user's awareness of events occurring on one side of the user or the other. A user could be asked, "Do you see anything on the left side of the screen?" Users with anosognosia (i.e., unawareness of a disability) may be strikingly unaware of severe deficits on the affected side. For example, some people with acute stroke who are completely paralyzed on the left side believe there is nothing wrong and may even be perplexed about why they are in the hospital. Alternatively, a neglect or construction test function set may include a user-health test function that presents a drawing task to a user **190** in the context of an application **104** that involves similar activities. A construction test involves prompting a user to draw complex figures or to manipulate objects in space. Difficulty in completing such a test may be a result of neglect or other visuospatial impairment.

[0118] Another neglect test function is a test of a user's ability to acknowledge a series of objects on a display that span a center point on the display. For example, a user may be prompted to click on each of 5 hash marks present in a horizontal line across the midline of a display. If the user has a neglect problem, she may only detect and accordingly click on the hash marks on one side of the display, neglecting the others.

[0119] Hemineglect is most common in lesions of the right (nondominant) parietal lobe, causing users to neglect the left side. Left-sided neglect can also occasionally be seen in right frontal lesions, right thalamic or basal ganglia lesions, and, rarely, in lesions of the right midbrain. Hemineglect or difficulty with construction tasks may be indicative of stroke (e.g., embolic, thrombotic, or due to vasculitis), or brain tumor (e.g., glioma or meningioma).

[0120] In the context of the above neglect test function and construction test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. **4-6** and their supporting text. Altered neglect attributes or construction ability may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered neglect attributes or construction ability associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0121] A task sequencing test function may include, for example, one or more perseveration test functions such as one or more written alternating sequencing test functions, one or more motor impersistence test functions, or one or more behavior control test functions.

[0122] A user's task sequencing attributes are indicators of a user's mental status. An example of a task sequencing test function may be a measure of a user's perseveration. For example, at least one device **102** may ask a user to continue drawing a silhouette pattern of alternating triangles and squares (i.e., a written alternating sequencing task) for a time period. In users with perseveration problems, the user may get stuck on one shape and keep drawing triangles. Another common finding is motor impersistence, a form of distractibility in which users only briefly sustain a motor action in response to a command such as "raise your arms" or "look to the right." Ability to suppress inappropriate behaviors can be tested by the auditory "Go-No-Go" test, in which the user performs a task such as moving an object (e.g., moving a finger) in response to one sound, but must keep the object (e.g., the finger) still in response to two sounds. Alternatively, at least one device **102** may prompt a user to perform a multi-step function in the context of an application **104**, for example. For example, a game may prompt a user **190** to enter a character's

name, equip an item from an inventory, an click on a certain direction of travel, in that order. Difficulty completing this task may indicate, for example, a frontal lobe defect associated with dementia.

[0123] Decreased ability to perform sequencing tasks may be indicative of stroke (e.g., embolic, thrombotic, or due to vasculitis), brain tumor (e.g., glioma or meningioma), or dementia (caused by, for example, Alzheimer's disease, vascular dementia, Parkinson's disease, Huntingdon's disease, Creutzfeldt-Jakob disease, Pick disease, head injury, infection (e.g., meningitis, encephalitis, HIV, or syphilis), normal pressure hydrocephalus, brain tumor, exposure to toxin (for example, lead or other heavy metals), metabolic disorders, hormone disorders, hypoxia (caused by, e.g., emphysema, pneumonia, or congestive heart failure), drug reactions (e.g., anti-cholinergic side effects, drug overuse, drug abuse (e.g., cocaine or heroin)).

[0124] In the context of the above task sequencing test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. 4-6 and their supporting text. Altered task sequencing ability may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered task sequencing ability associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0125] Operation **708** depicts selecting at least one of a visual field test function, an eye movement test function, a pupil movement test function, a face pattern test function, a hearing test function, or a voice test function. For example, a user-health test function selection module **138** may select a visual field test function based on user-health data, for example, cranial nerve test function output data provided by a user-health test function unit **140**.

[0126] Selecting at least one of a visual field test function, an eye movement test function, a pupil movement test function, a face pattern test function, a hearing test function, or a voice test function may be done based on obtained user-health data, as described above. In general, obtaining user-health data of a certain type may trigger selection of at least one user-health test function that relates to the user-health data. For example, user-health data obtained in the form of altered visual field data may trigger the selection of one or more additional visual field test functions in order to track visual field over time, or to examine different aspect of user vision (e.g., visual acuity).

[0127] Alternatively, for example, user-health data in the form of a user's medical history may trigger the selection of related test functions. For example, obtaining from a medical records database information indicating injury to the neck or

apical chest area may result in the selection of a related cranial nerve test function, such as a voice test function to measure vagus nerve damage, e.g., via vocal chord function. Selection algorithms may be applied by one of skill in the art according to user-health data and related known user-health test functions, and those disclosed herein.

[0128] A visual field test function may include, for example, one or more visual field test functions, one or more pointing device manipulation test functions, and/or one more reading test functions.

[0129] Visual field user attributes are indicators of a user's ability to see directly ahead and peripherally. An example of a visual field test function may be a measure of a user's gross visual acuity, for example using a Snellen eye chart or visual equivalent on a display. Alternatively, a campimeter may be used to conduct a visual field test. A device **102** and/or user-health test function unit **140** may contain a user-health test function set **196** including a user-health test function that may prompt a user **190** to activate a portion of a display when the user **190** can detect an object entering their field of view from a peripheral location relative to a fixed point of focus, either with both eyes or with one eye covered at a time. Such testing could be done in the context of, for example, new email alerts that require clicking and that appear in various locations on a display. Based upon the location of decreased visual field, the defect can be localized, for example in a quadrant system. A pre-chiasmatic lesion results in ipsilateral eye blindness. A chiasmatic lesion can result in bi-temporal hemianopsia (i.e., tunnel vision). Post-chiasmatic lesions proximal to the geniculate ganglion can result in left or right homonymous hemianopsia. Lesions distal to the geniculate ganglion can result in upper or lower homonymous quadrantanopsia.

[0130] Visual field defects may indicate optic nerve conditions such as pre-chiasmatic lesions, which include fractures of the sphenoid bone (e.g., transecting the optic nerve), retinal tumors, or masses compressing the optic nerve. Such conditions may result in unilateral blindness and unilaterally unreactive pupil (although the pupil may react to light applied to the contralateral eye). Bi-temporal hemianopsia can be caused by glaucoma, pituitary adenoma, craniopharyngioma or saccular Berry aneurysm at the optic chiasm. Post-chiasmatic lesions are associated with homonymous hemianopsia or quadrantanopsia depending on the location of the lesion.

[0131] In the context of the above visual field test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. 4-6 and their supporting text. Altered visual field may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered visual field associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H.,

“Adams and Victor’s Principles of Neurology,” 7th Ed., McGraw-Hill, New York, 2001.

[0132] An eye movement test function or a pupil movement test function may include, for example, one or more eye movement test functions, one more pupil movement test functions, and/or one or more pointing device manipulation test functions.

[0133] An example of an eye movement test function may be a measurement of a user’s ability to follow a target on a display with her eyes throughout a 360° range. Such testing may be done in the context of a user playing a game or participating in a videoconference. In such examples, user-health data **116** may be obtained through a camera in place as a user monitoring device **182** that can monitor the eye movements of the user during interaction with the application **104**.

[0134] Another example of an eye movement test function may include eye tracking data from a user monitoring device, such as a video communication device, for example, when a user task requires tracking objects on a display, reading, or during resting states between activities in an application. A further example includes pupil movement tracking data from the user **190** at rest or during an activity required by an application or user-health test function.

[0135] Testing of the trochlear nerve or the abducens nerve for damage may involve measurement of extraocular movements. The trochlear nerve performs intorsion, depression, and abduction of the eye. A trochlear nerve lesion may present as extorsion of the ipsilateral eye and worsened diplopia when looking down. Damage to the abducens nerve may result in a decreased ability to abduct the eye.

[0136] Abnormalities in eye movement may indicate fracture of the sphenoid wing, intracranial hemorrhage, neoplasm, or aneurysm. Such insults may present as extorsion of the ipsilateral eye. Individuals with this condition complain of worsened diplopia with attempted downgaze, but improved diplopia with head tilted to the contralateral side. Injury to the abducens nerve may be caused by aneurysm, a mass in the cavernous sinus, or a fracture of the skull base. Such insults may result in extraocular palsy defined by medial deviation of the ipsilateral eye. Users with this condition may present with diplopia that improves when the contralateral eye is abducted.

[0137] Nystagmus is a rapid involuntary rhythmic eye movement, with the eyes moving quickly in one direction (quick phase), and then slowly in the other direction (slow phase). The direction of nystagmus is defined by the direction of its quick phase (e.g., right nystagmus is due to a right-moving quick phase). Nystagmus may occur in the vertical or horizontal directions, or in a semicircular movement. Terminology includes downbeat nystagmus, upbeat nystagmus, seesaw nystagmus, periodic alternating nystagmus, and pendular nystagmus. There are other similar alterations in periodic eye movements (saccadic oscillations) such as opsoclonus or ocular flutter. One can think of nystagmus as the combination of a slow adjusting eye movement (slow phase) as would be seen with the vestibulo-ocular reflex, followed by a quick saccade (quick phase) when the eye has reached the limit of its rotation.

[0138] In medicine, the clinical importance of nystagmus is that it indicates that the user’s spatial sensory system perceives rotation and is rotating the eyes to adjust. Thus it depends on the coordination of activities between two major physiological systems: the vision and the vestibular apparatus

(which controls posture and balance). This may be physiological (i.e., normal) or pathological.

[0139] Vestibular nystagmus may be central or peripheral. Important differentiating features between central and peripheral nystagmus include the following: peripheral nystagmus is unidirectional with the fast phase opposite the lesion; central nystagmus may be unidirectional or bidirectional; purely vertical or torsional nystagmus suggests a central location; central vestibular nystagmus is not dampened or inhibited by visual fixation; tinnitus or deafness often is present in peripheral vestibular nystagmus, but it usually is absent in central vestibular nystagmus. According to Alexander’s law, the nystagmus associated with peripheral lesions becomes more pronounced with gaze toward the side of the fast-beating component; with central nystagmus, the direction of the fast component is directed toward the side of gaze (e.g., left-beating in left gaze, right-beating in right gaze, and up-beating in upgaze).

[0140] Downbeat nystagmus is defined as nystagmus with the fast phase beating in a downward direction. The nystagmus usually is of maximal intensity when the eyes are deviated temporally and slightly inferiorly. With the eyes in this position, the nystagmus is directed obliquely downward. In most users, removal of fixation (e.g., by Frenzel goggles) does not influence slow phase velocity to a considerable extent, however, the frequency of saccades may diminish.

[0141] The presence of downbeat nystagmus is highly suggestive of disorders of the cranio-cervical junction (e.g., Arnold-Chiari malformation). This condition also may occur with bilateral lesions of the cerebellar flocculus and bilateral lesions of the medial longitudinal fasciculus, which carries optokinetic input from the posterior semicircular canals to the third nerve nuclei. It may also occur when the tone within pathways from the anterior semicircular canals is relatively higher than the tone within the posterior semicircular canals. Under such circumstances, the relatively unopposed neural activity from the anterior semicircular canals causes a slow upward pursuit movement of the eyes with a fast, corrective downward saccade. Additional causes include demyelination (e.g., as a result of multiple sclerosis), microvascular disease with vertebrobasilar insufficiency, brain stem encephalitis, tumors at the foramen magnum (e.g., meningioma, or cerebellar hemangioma), trauma, drugs (e.g., alcohol, lithium, or anti-seizure medications), nutritional imbalances (e.g., Wernicke encephalopathy, parenteral feeding, magnesium deficiency), or heat stroke.

[0142] Upbeat nystagmus is defined as nystagmus with the fast phase beating in an upward direction. Daroff and Troost described two distinct types. The first type consists of a large amplitude nystagmus that increases in intensity with upward gaze. This type is suggestive of a lesion of the anterior vermis of the cerebellum. The second type consists of a small amplitude nystagmus that decreases in intensity with upward gaze and increases in intensity with downward gaze. This type is suggestive of lesions of the medulla, including the perihypoglossal nuclei, the adjacent medial vestibular nucleus, and the nucleus intercalatus (structures important in gaze-holding). Upbeat nystagmus may also be an indication of benign paroxysmal positional vertigo.

[0143] Torsional (rotary) nystagmus refers to a rotary movement of the globe about its anteroposterior axis. Torsional nystagmus is accentuated on lateral gaze. Most nystagmus resulting from dysfunction of the vestibular system has a torsional component superimposed on a horizontal or vertical

nystagmus. This condition occurs with lesions of the anterior and posterior semicircular canals on the same side (e.g., lateral medullary syndrome or Wallenberg syndrome). Lesions of the lateral medulla may produce a torsional nystagmus with the fast phase directed away from the side of the lesion. This type of nystagmus can be accentuated by otolithic stimulation by placing the user on their side with the intact side down (e.g., if the lesion is on the left, the nystagmus is accentuated when the user is placed on his right side).

[0144] This condition may occur when the tone within the pathways of the posterior semicircular canals is relatively higher than the tone within the anterior semicircular canals, and it can occur from lesions of the ventral tegmental tract or the brachium conjunctivum, which carry optokinetic input from the anterior semicircular canals to the third nerve nuclei.

[0145] Pendular nystagmus is a multivectorial nystagmus (i.e., horizontal, vertical, circular, and elliptical) with an equal velocity in each direction that may reflect brain stem or cerebellar dysfunction. Often, there is marked asymmetry and dissociation between the eyes. The amplitude of the nystagmus may vary in different positions of gaze. Causes of pendular nystagmus may include demyelinating disease, monocular or binocular visual deprivation, oculopalatal myoclonus, internuclear ophthalmoplegia, or brain stem or cerebellar dysfunction.

[0146] Horizontal nystagmus is a well-recognized finding in patients with a unilateral disease of the cerebral hemispheres, especially with large, posterior lesions. It often is of low amplitude. Such patients show a constant velocity drift of the eyes toward the intact hemisphere with fast saccade directed toward the side of the lesion.

[0147] Seesaw nystagmus is a pendular oscillation that consists of elevation and intorsion of one eye and depression and extorsion of the fellow eye that alternates every half cycle. This striking and unusual form of nystagmus may be seen in patients with chiasmal lesions, suggesting loss of the crossed visual inputs from the decussating fibers of the optic nerve at the level of the chiasm as the cause or lesions in the rostral midbrain. This type of nystagmus is not affected by otolithic stimulation. Seesaw nystagmus may also be caused by parasellar lesions or visual loss secondary to retinitis pigmentosa.

[0148] Gaze-evoked nystagmus is produced by the attempted maintenance of an extreme eye position. It is the most common form of nystagmus. Gaze-evoked nystagmus is due to a deficient eye position signal in the neural integrator network. Thus, the eyes cannot be maintained at an eccentric orbital position and are pulled back toward primary position by the elastic forces of the orbital fascia. Then, corrective saccade moves the eyes back toward the eccentric position in the orbit.

[0149] Gaze-evoked nystagmus may be caused by structural lesions that involve the neural integrator network, which is dispersed between the vestibulocerebellum, the medulla (e.g., the region of the nucleus prepositus hypoglossi and adjacent medial vestibular nucleus "NPH/MVN"), and the interstitial nucleus of Cajal ("INC"). Patients recovering from a gaze palsy go through a period where they are able to gaze in the direction of the previous palsy, but they are unable to sustain gaze in that direction; therefore, the eyes drift slowly back toward primary position followed by a corrective saccade. When this is repeated, a gaze-evoked or gaze-paretic nystagmus results.

[0150] Gaze-evoked nystagmus often is encountered in healthy users; in which case, it is called end-point nystagmus. End-point nystagmus usually can be differentiated from gaze-evoked nystagmus caused by disease, in that the former has lower intensity and, more importantly, is not associated with other ocular motor abnormalities. Gaze-evoked nystagmus also may be caused by alcohol or drugs including anti-convulsants (e.g., phenobarbital, phenytoin, or carbamazepine) at therapeutic dosages.

[0151] Spasmus nutans is a rare condition with the clinical triad of nystagmus, head nodding, and torticollis. Onset is from age 3-15 months with disappearance by 3 or 4 years. Rarely, it may be present to age 5-6 years. The nystagmus typically consists of small-amplitude, high frequency oscillations and usually is bilateral, but it can be monocular, asymmetric, and variable in different positions of gaze. Spasmus nutans occurs in otherwise healthy children. Chiasmal, suprachiasmatal, or third ventricle gliomas may cause a condition that mimics spasmus nutans.

[0152] Periodic alternating nystagmus is a conjugate, horizontal jerk nystagmus with the fast phase beating in one direction for a period of approximately 1-2 minutes. The nystagmus has an intervening neutral phase lasting 10-20 seconds; the nystagmus begins to beat in the opposite direction for 1-2 minutes; then the process repeats itself. The mechanism may be disruption of the vestibulo-ocular tracts at the pontomedullary junction. Causes of periodic alternating nystagmus may include Arnold-Chiari malformation, demyelinating disease, spinocerebellar degeneration, lesions of the vestibular nuclei, head trauma, encephalitis, syphilis, posterior fossa tumors, or binocular visual deprivation (e.g., ocular media opacities).

[0153] Abducting nystagmus of internuclear ophthalmoplegia ("INO") is nystagmus in the abducting eye contralateral to a medial longitudinal fasciculus ("MLF") lesion.

[0154] An example of a pupil movement test function may be a measure of a user's pupils when exposed to light or objects at various distances. A pupillary movement test may assess the size and symmetry of a user's pupils before and after a stimulus, such as light or focal point. Anisocoria (i.e., unequal pupils) of up to 0.5 mm is fairly common, and is benign provided pupillary reaction to light is normal. Pupillary reflex can be tested in a darkened room by shining light in one pupil and observing any constriction of the ipsilateral pupil (direct reflex) or the contralateral pupil (contralateral reflex). If abnormality is found with light reaction, pupillary accommodation can be tested by having the user focus on an object at a distance, then focus on the object at about 10 cm from the nose. Pupils should converge and constrict at close focus.

[0155] Pupillary abnormalities may be a result of either optic nerve or oculomotor nerve lesions. An optic nerve lesion (e.g., blind eye) will not react to direct light and will not elicit a consensual pupillary constriction, but will constrict if light is shown in the opposite eye. A Horner's syndrome lesion (sympathetic chain lesion) can also present as a pupillary abnormality. In Horner's syndrome, the affected pupil is smaller but constricts to both light and near vision and may be associated with ptosis and anhidrosis. In an oculomotor nerve lesion, the affected pupil is fixed and dilated and may be associated with ptosis and lateral deviation (due to unopposed action of the abducens nerve). Small pupils that do not react to light but do constrict with near vision (i.e., accommodate

but do not react to light) can be seen in central nervous system syphilis ("Argyll Robertson pupil").

[0156] Pupillary reflex deficiencies may indicate damage to the oculomotor nerve in basilar skull fracture or uncus herniation as a result of increased intracranial pressure. Masses or tumors in the cavernous sinus, syphilis, or aneurysm may also lead to compression of the oculomotor nerve. Injury to the oculomotor nerve may result in ptosis, inferolateral displacement of the ipsilateral eye (which can present as diplopia or strabismus), or mydriasis.

[0157] In the context of the above eye movement test function or pupil movement test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. **4-6** and their supporting text. Altered eye movement ability or pupil movement ability may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered eye movement ability or pupil movement ability associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0158] A face pattern test function may include, for example, one or more face movement test functions involving a user's ability to move the muscles of the face. An example of a face pattern test function may be a comparison of a user's face while at rest, specifically looking for nasolabial fold flattening or drooping of the corner of the mouth, with the user's face while moving certain facial features. The user may be asked to raise her eyebrows, wrinkle her forehead, show her teeth, puff out her cheeks, or close her eyes tight. Such testing may done via facial pattern recognition software used in conjunction with, for example, a videoconferencing application. Any weakness or asymmetry may indicate a lesion in the facial nerve. In general, a peripheral lesion of the facial nerve may affect the upper and lower face while a central lesion may only affect the lower face.

[0159] Abnormalities in facial expression or pattern may indicate a petrous fracture. Peripheral facial nerve injury may also be due to compression, tumor, or aneurysm. Bell's Palsy is thought to be caused by idiopathic inflammation of the facial nerve within the facial canal. A peripheral facial nerve lesion involves muscles of both the upper and lower face and can involve loss of taste sensation from the anterior 2/3 of the tongue (via the chorda tympani). A central facial nerve palsy due to tumor or hemorrhage results in sparing of upper and frontal orbicularis oculi due to crossed innervation. Sparing ability to raise eyebrows and wrinkle the forehead helps differentiate a peripheral palsy from a central process. This also may indicate stroke or multiple sclerosis.

[0160] In the context of the above face pattern test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. **4-6** and their supporting text. Altered face pattern may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered face pattern associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0161] A hearing test function may include, for example, one or more conversation hearing test functions such as one or more tests of a user's ability to detect conversation, for example in a teleconference or videoconference scenario, one or more music detection test functions, or one more device sound effect test functions, for example in a game scenario.

[0162] An example of a hearing test function may be a gross hearing assessment of a user's ability to hear sounds. This can be done by simply presenting sounds to the user or determining if the user can hear sounds presented to each of the ears. For example, at least one device **102** may vary volume settings or sound frequency on a user's device **102** or within an application **104** over time to test user hearing. For example, a mobile phone device or other communication device may carry out various hearing test functions.

[0163] Petrous fractures that involve the vestibulocochlear nerve may result in hearing loss, vertigo, or nystagmus (frequently positional) immediately after the injury. Severe middle ear infection can cause similar symptoms but have a more gradual onset. Acoustic neuroma is associated with gradual ipsilateral hearing loss. Due to the close proximity of the vestibulocochlear nerve with the facial nerve, acoustic neuromas often present with involvement of the facial nerve. Neurofibromatosis type II is associated with bilateral acoustic neuromas. Vertigo may be associated with anything that compresses the vestibulocochlear nerve including vascular abnormalities, inflammation, or neoplasm.

[0164] In the context of the above hearing test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. **4-6** and their supporting text. Altered hearing ability may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered hearing ability associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1.

[0165] In the context of the above hearing test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. **4-6** and their supporting text. Altered hearing ability may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered hearing ability associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1.

html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0165] A voice test function may include, for example, one or more voice test functions. An example of a voice test function may be a measure of symmetrical elevation of the palate when the user says "aah," or a test of the gag reflex. In an ipsilateral lesion of the vagus nerve, the uvula deviates towards the affected side. As a result of its innervation (through the recurrent laryngeal nerve) to the vocal cords, hoarseness may develop as a symptom of vagus nerve injury. A voice test function and/or user-health test unit 104 may monitor user voice frequency or volume data during, for example, gaming, videoconferencing, speech recognition software use, or mobile phone use. Injury to the recurrent laryngeal nerve can occur with lesions in the neck or apical chest. The most common lesions are tumors in the neck or apical chest. Cancers may include lung cancer, esophageal cancer, or squamous cell cancer.

[0166] Other voice test functions may involve first observing the tongue (while in floor of mouth) for fasciculations. If present, fasciculations may indicate peripheral hypoglossal nerve dysfunction. Next, the user may be prompted to protrude the tongue and move it in all directions. When protruded, the tongue will deviate toward the side of a lesion (as the unaffected muscles push the tongue more than the weaker side). Gross symptoms of pathology may result in garbled sound in speech (as if there were marbles in the user's mouth). Damage to the hypoglossal nerve affecting voice/speech may indicate neoplasm, aneurysm, or other external compression, and may result in protrusion of the tongue away from side of the lesion for an upper motor neuron process and toward the side of the lesion for a lower motor neuron process. Accordingly, a voice test function and/or user-health test unit 104 may assess a user's ability to make simple sounds or to say words, for example, consistently with an established voice pattern for the user.

[0167] In the context of the above voice test function, as set forth herein, available obtained user-health data 116 are one or more of various types of user-health data 116 described in FIGS. 4-6 and their supporting text. Altered voice may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered voice associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and

Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0168] Operation 710 depicts selecting at least one of a body movement test function or a motor skill test function. For example, a user-health test function selection module 138 may select a body movement test function or a motor skill test function based on user-health data, for example, cerebellum test function output data provided by a user-health test function unit 140.

[0169] An example of a body movement test function may include prompting a user 190 to activate or click a specific area on a display to test, for example, arm movement, hand movement, or other body movement or motor skill function. Another example is visual tracking of a user's body, for example during a videoconference, wherein changes in facial movement, limb movement, or other body movements are detectable. A further example is testing a user's ability to move while using a game controller containing an accelerometer, for example, the Wii remote that is used for transmitting user movement data to a computing device.

[0170] Another example of a body movement test function may be first observing the user for atrophy or fasciculation in the trapezius muscles, shoulder drooping, or displacement of the scapula. A body movement test function may then prompt the user to turn the head and shrug shoulders against resistance. Weakness in turning the head in one direction may indicate a problem in the contralateral spinal accessory nerve, while weakness in shoulder shrug may indicate an ipsilateral spinal accessory nerve lesion. Ipsilateral paralysis of the sternocleidomastoid and trapezius muscles due to neoplasm, aneurysm, or radical neck surgery also may indicate damage to the spinal accessory nerve. A body movement test function may perform gait analysis, for example, in the context of a security system surveillance application involving video monitoring of the user.

[0171] Cerebellar disorders can disrupt body coordination or gait while leaving other motor functions relatively intact. The term ataxia is often used to describe the abnormal movements seen in coordination disorders. In ataxia, there are medium- to large-amplitude involuntary movements with an irregular oscillatory quality superimposed on and interfering with the normal smooth trajectory of movement. Overshoot is also commonly seen as part of ataxic movements and is sometimes referred to as "past pointing" when target-oriented movements are being discussed. Another feature of coordination disorders is dysdiadochokinesia (i.e., abnormal alternating movements). Cerebellar lesions can cause different kinds of coordination problems depending on their location. One important distinction is between truncal ataxia and appendicular ataxia. Appendicular ataxia affects movements of the extremities and is usually caused by lesions of the cerebellar hemispheres and associated pathways. Truncal ataxia affects the proximal musculature, especially that involved in gait stability, and is caused by midline damage to the cerebellar vermis and associated pathways.

[0172] A body movement user-health test function may also include a user-health test function of fine movements of the hands and feet. Rapid alternating movements, such as wiping one palm alternately with the palm and dorsum of the other hand, may be tested as well. A common test of coordination is the finger-nose-finger test, in which the user is asked to alternately touch their nose and an examiner's finger as quickly as possible. Ataxia may be revealed if the examiner's finger is held at the extreme of the user's reach, and if the

examiner's finger is occasionally moved suddenly to a different location. Overshoot may be measured by having the user raise both arms suddenly from their lap to a specified level in the air. In addition, pressure can be applied to the user's outstretched arms and then suddenly released. Alternatively, testing of fine movements of the hands may be tested by measuring a user's ability to make fine movements of a cursor on a display. To test the accuracy of movements in a way that requires very little strength, a user can be prompted to repeatedly touch a line drawn on the crease of the user's thumb with the tip of their forefinger; alternatively, a user may be prompted to repeatedly touch an object on a touchscreen display.

[0173] Normal performance of motor tasks depends on the integrated functioning of multiple sensory and motor subsystems. These include position sense pathways, lower motor neurons, upper motor neurons, the basal ganglia, and the cerebellum. Thus, in order to convincingly demonstrate that abnormalities are due to a cerebellar lesion, one should first test for normal joint position sense, strength, and reflexes and confirm the absence of involuntary movements caused by basal ganglia lesions. As discussed above, appendicular ataxia is usually caused by lesions of the cerebellar hemispheres and associated pathways, while truncal ataxia is often caused by damage to the midline cerebellar vermis and associated pathways.

[0174] Another body movement test is the Romberg test, which may indicate a problem in the vestibular or proprioception system. A user is asked to stand with feet together (touching each other). Then the user is prompted to close their eyes. If a problem is present, the user may begin to sway or fall. With the eyes open, three sensory systems provide input to the cerebellum to maintain truncal stability. These are vision, proprioception, and vestibular sense. If there is a mild lesion in the vestibular or proprioception systems, the user is usually able to compensate with the eyes open. When the user closes their eyes, however, visual input is removed and instability can be brought out. If there is a more severe proprioceptive or vestibular lesion, or if there is a midline cerebellar lesion causing truncal instability, the user will be unable to maintain this position even with their eyes open.

[0175] A motor skill test function may include, for example, one or more deliberate body movement test functions such as one or more tests of a user's ability to move an object, including objects on a display, e.g., a cursor.

[0176] An example of a motor skill test function may be a measure of a user's ability to perform a physical task. A motor skill test function may measure, for example, a user's ability to traverse a path on a display in straight line with a pointing device, to type a certain sequence of characters without error, or to type a certain number of characters without repetition. For example, a wobbling cursor on a display may indicate ataxia in the user, or a wobbling cursor while the user is asked to maintain the cursor on a fixed point on a display may indicate early Parkinson's disease symptoms. Alternatively, a user may be prompted to switch tasks, for example, to alternately type some characters using a keyboard and click on some target with a mouse. If a user has a motor skill deficiency, she may have difficulty stopping one task and starting the other task.

[0177] In clinical practice, characterization of tremor is important for etiologic consideration and treatment. Common types of tremor include resting tremor, postural tremor, action or kinetic tremor, task-specific tremor, or intention or

terminal tremor. Resting tremor occurs when a body part is at complete rest against gravity. Tremor amplitude tends to decrease with voluntary activity. Causes of resting tremor may include Parkinson's disease, Parkinson-plus syndromes (e.g., multiple system atrophy, progressive supranuclear palsy, or corticobasal degeneration), Wilson's disease, drug-induced Parkinsonism (e.g., neuroleptics, Reglan, or phentiazines), or long-standing essential tremor.

[0178] Postural tremor occurs during maintenance of a position against gravity and increases with action. Action or kinetic tremor occurs during voluntary movement. Examples of postural and action tremors may include essential tremor (primarily postural), metabolic disorders (e.g., thyrotoxicosis, pheochromocytoma, or hypoglycemia), drug-induced parkinsonism (e.g., lithium, amiodarone, or beta-adrenergic agonists), toxins (e.g., alcohol withdrawal, heavy metals), neuropathic tremor (e.g., neuropathy).

[0179] Task-specific tremor emerges during specific activity. An example of this type is primary writing tremor. Intention or terminal tremor manifests as a marked increase in tremor amplitude during a terminal portion of targeted movement. Examples of intention tremor include cerebellar tremor and multiple sclerosis tremor.

[0180] In the context of the above body movement test function or motor skill test function, as set forth herein, available obtained user-health data **116** are one or more of various types of user-health data **116** described in FIGS. **4-6** and their supporting text. Altered body movement or motor skill may indicate certain of the possible conditions discussed above. One skilled in the art can select, establish or determine user-health test functions relating to the one or more types of user-health data indicative of altered body movement or motor skill associated with a likely condition. Test function sets and test functions can be chosen by one skilled in the art based on knowledge, direct experience, or using available resources such as websites, textbooks, journal articles, or the like. An example of a relevant website can be found in the online Merck Manual at http://www.merck.com/mmhe/sec06/ch077/ch077c.html#tb077_1. Examples of relevant textbooks include Patten, J. P., "Neurological Differential Diagnosis," Second Ed., Springer-Verlag, London, 2005; Kasper, Braunwald, Fauci, Hauser, Longo, and Jameson, "Harrison's Principles of Internal Medicine," 16th Ed., McGraw-Hill, New York, 2005; Greenberg, M. S., "Handbook of Neurosurgery," 6th Ed., Thieme, Lakeland, 2006; and Victor, M., and Ropper, A. H., "Adams and Victor's Principles of Neurology," 7th Ed., McGraw-Hill, New York, 2001.

[0181] FIG. **8** illustrates alternative embodiments of the example operational flow **300** of FIG. **3**. FIG. **8** illustrates example embodiments where the applying operation **330** may include at least one additional operation. Additional operations may include operation **800**, **802** and/or operation **804**.

[0182] Operation **800** depicts applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user input data. For example, at least one device **102** may have installed on it at least one application **104** whose primary function is different from symptom detection, the application **104** being operable on the at least one device **102**. Such an application **104** may generate user-health data **116** via a user input device **180**, a user monitoring device **182**, or a user interface **184** from an interaction with user **190**. For example, the at least

one device **102**, user-health test function unit **140** and/or user-health test function selection module **138** can apply at least one attention test function to an interaction between a user **190** and an interactive application on a web browser. The attention test function may act in conjunction with the interactive application on the web browser to prompt the user to enter keystroke data to complete the attention test, for example spelling a word forward and backwards, or typing a block of text with a certain level of fidelity. Other examples of user input data include activating a touchscreen by tapping or other means, and user voice input. Other examples of appropriate contexts for user input data may include memory test functions, task sequencing functions, and/or motor skill test functions.

[0183] The at least one device **102** and/or user-health test function unit **140** may apply a user-health test function in response to, for example, a user-health test function selection module **138** selecting the user-health test function at least partly based on a user's medical history data and/or user-health test function output data.

[0184] Operation **802** depicts applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user image data. For example, at least one application **104** whose primary function is different from symptom detection may have be operable on at least one device **102** via a remote link such as network **192**. A user's interaction with such an application **104** may generate user-health data **116** via a user input device **180**, a user monitoring device **182**, or a user interface **184**. For example, the at least one device **102**, user-health test function unit **140** and/or user-health test function selection module **138** can apply at least one eye movement test function to an interaction between a user **190** and a videocommunications application operable on a device **102**. The eye movement test function may act in conjunction with the videocommunications application on the device **102** to monitor the user's eye movements in the form of captured user image data. Other examples of appropriate contexts for user image data may include body movement test functions, pupil movement test functions, neglect test functions, and/or face pattern test functions.

[0185] The at least one device **102** and/or user-health test function unit **140** may apply a user-health test function in response to, for example, a user-health test function selection module **138** selecting the user-health test function at least partly based on a user's medical history data and/or user-health test function output data.

[0186] Operation **804** depicts applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user pointing device manipulation data. For example, at least one device **102** may have installed on it at least one application **104** whose primary function is different from symptom detection, the application **104** being operable on the at least one device **102**. Such an application **104** may generate user-health data **116** via a user input device **180**, a user monitoring device **182**, or a user interface **184** as a result of an interaction with user **190**. For example, the at least one device **102**, user-health test function unit **140** and/or user-health test function selection module **138** can apply at least one motor skill test func-

tion to an interaction between a user **190** and a game operable on the device **102**. The motor skill test function may act in conjunction with the game to prompt the user to move a cursor within the game environment to activate objects, perhaps within a specified time. Other examples of appropriate contexts for pointing device manipulation data input may include body movement test functions, task sequencing functions, and/or reaction time test functions.

[0187] Examples of pointing devices include a computer mouse, a trackball, a touchscreen (e.g., on a personal digital assistant, on a laptop computer, or on a table surface computer), a joystick or other perspective-orienting device (e.g., a remote motion-sensor having accelerometer motion-detection capability), or other means of moving a cursor on a display or altering the perspective of an image on a display, including an image in a virtual environment.

[0188] The at least one device **102** and/or user-health test function unit **140** may apply a user-health test function in response to, for example, a user-health test function selection module **138** selecting the user-health test function at least partly based on a user's medical history data and/or user-health test function output data.

[0189] FIG. **9** illustrates alternative embodiments of the example operational flow **300** of FIG. **3**. FIG. **9** illustrates example embodiments where the applying operation **330** may include at least one additional operation. Additional operations may include operation **900**, **902**, and/or operation **904**.

[0190] Operation **900** depicts applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented game whose primary function is different from symptom detection. For example, at least one device **102** may have installed on it at least one game **106** whose primary function is different from symptom detection, the game **106** being operable on the at least one device **102**. Such a game **106** may generate user-health data **116** via a user input device **180**, a user monitoring device **182**, or a user interface **184** as a result of an interaction with user **190**. For example, the at least one device **102**, user-health test function unit **140** and/or user-health test function selection module **138** can apply at least one calculation test function to an interaction between a user **190** and a game operable on the device **102**. The calculation test function may act in conjunction with the game to prompt the user to, for example, count, add, and/or subtract objects within the game environment. Other examples of a game **106** may include a cell phone game or other computer game such as, for example, solitaire, puzzle games, role-playing games, first-person shooting games, strategy games, sports games, racing games, adventure games, or the like. Such games may be played offline or through a network (e.g., online games).

[0191] For example, within a game situation, a user may be prompted to click on one or more targets within the normal gameplay parameters. User reaction time data may be collected once or many times for this task. The user reaction time data may be mapped to, for example, a mental status test function or a motor skill test function. User health data **116**, including user reaction time test function output data, may indicate altered reaction time that are characteristic of a change in attention, such as loss of focus. The at least one device **102** and/or user-health test function selection module **138** may therefore select a user-health test function to test user attention, such as a test of the user's ability to accurately click a series of targets on a display within a period of time. Based on the outcome of this test, the device **102** and/or

user-health test function unit can apply another reaction time test function, a motor skill test function, or other appropriate user-health test function.

[0192] Operation 902 depicts applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented communications application whose primary function is different from symptom detection. For example, at least one application 104 whose primary function is different from symptom detection may be operable on at least one device 102 through a network 192. The at least one application 104 may be resident, for example on a server that is remote relative to the at least one device 102. Such an application 104 may generate user-health data 116 via a user input device 180, a user monitoring device 182 or a user interface 184. The at least one device 102 and/or user-health test function unit 140 can apply at least one user-health test function to at least one device-implemented communications application whose primary function is different from symptom detection.

[0193] The at least one device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply a selected user-health test function to a communications application. For example, based on user-health test function output data indicating altered user speech function, the at least one device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply a speech test function that monitors slurring of speech or stuttering during conversation of a user 190 on a cell phone.

[0194] Another example may include applying a user-health test function based on user-health data indicating a specific health diagnosis, such as dementia. In this example, the at least one device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply a memory test function that, for example, asks the user 190 to enter her mother's maiden name or other long term memory characteristic in the context of an email program.

[0195] Examples of a communication application 108 may include various forms of one-way or two-way information transfer, typically to, from, between, or among devices. Some examples of communications applications include: an email program, a telephony application, a videocommunications function, an internet or other network messaging program, a cell phone communication application, or the like. Such a communication application may operate via text, voice, video, or other means of communication, combinations of these, or other means of communication.

[0196] Operation 904 depicts applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented email application, telephony application, or telecommunications application. For example, at least one application 104 whose primary function is different from symptom detection may be operable on at least one device 102 through a network 192. The at least one application 104 may be resident, for example on a server that is remote relative to the at least one device 102. Such an application 104 may generate user-health data 116 via a user input device 180, a user monitoring device 182 or a user interface 184. The at least one device 102 and/or user-health test function unit 140 can apply at least one user-health test function to at least one device-implemented email application, telephony application, or telecommunications application whose primary function is different from symptom detection.

[0197] The at least one device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply a selected user-health test function to an email application, a telephony application, or a telecommunications application. For example, based on user-health test function output data indicating an altered user face pattern, the at least one device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply a face pattern test function that monitors facial features and/or facial feature movement during a video conference, web video chat, cell phone photograph or video, or the like.

[0198] Another example may include applying a user-health test function based on user-health data indicating a specific health diagnosis, such as depression. In this example, the at least one device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply a speech test function that, for example, monitors the abundance of a user's spontaneous speech during a time interval in the context of a cell phone application.

[0199] Other examples of telecommunications applications include instant messaging, interactions of users with social networking internet sites (e.g., YouTube.com, MySpace.com, or the like), or other personal text, sound, or video messaging.

[0200] FIG. 10 illustrates alternative embodiments of the example operational flow 300 of FIG. 3. FIG. 10 illustrates example embodiments where the applying operation 330 may include at least one additional operation. Additional operations may include operation 1000, 1002, 1004, and/or operation 1006.

[0201] Operation 1000 depicts applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented productivity application whose primary function is different from symptom detection. For example, at least one device 102 may have installed on it at least one productivity application 112 whose primary function is different from symptom detection, the productivity application 112 being operable on the at least one device 102. User interaction with such a productivity application 112 may generate user-health data 116 via a user input device 180 and/or a user monitoring device 182. For example, the at least one device 102, user-health test function unit 140 and/or user-health test function selection module 138 can apply at least one motor skill test function to an interaction between a user 190 and a productivity application 112 operable on the device 102. The motor skill test function may act in conjunction with the productivity application 112 to monitor the user's typing ability or pointing device manipulation ability within the parameters of the productivity application 112, or as an adjunct to actions within the productivity application 112. Examples of a productivity application 112 may include a word processing program, a spreadsheet program, other business software, or the like.

[0202] Other examples of productivity applications may include a computer-aided drafting ("CAD") application, an educational application, a project management application, a geographic information system ("GIS") application, or the like.

[0203] For example, a user 190 may interact with a word processing application via a keyboard or other text input device. A device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply, for example, a mental status test function that, for example,

monitors the rate of use of the backspace key as a measure of a user's mental acuity, attention, and/or alertness.

[0204] Operation 1002 depicts applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented word processing application, spreadsheet application, or presentation application. For example, at least one device 102 may have installed on it at least one word processing application, spreadsheet application, or presentation application whose primary function is different from symptom detection, the word processing application, spreadsheet application, or presentation application being operable on the at least one device 102. User interaction with such a word processing application, spreadsheet application, or presentation application may generate user-health data 116 via a user input device 180 and/or a user monitoring device 182. For example, the at least one device 102, user-health test function unit 140 and/or user-health test function selection module 138 can apply at least one attention test function to an interaction between a user 190 and a word processing application, spreadsheet application, or presentation application operable on the device 102. The attention test function may act in conjunction with the word processing application, spreadsheet application, or presentation application to monitor the user's typing ability, calculation ability, reading ability, or pointing device manipulation ability, for example, within the parameters of the word processing application, spreadsheet application, or presentation application, or as an adjunct to actions within the word processing application, spreadsheet application, or presentation application.

[0205] For example, a user 190 may interact with a spreadsheet application via a keyboard or other text or number input device. A device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply, for example, a mental status test function that, for example, prompts the user to calculate a sum or construct an equation within the spreadsheet as a measure of the user's attention.

[0206] Operation 1004 depicts applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented security application whose primary function is different from symptom detection. For example, at least one device 102 may be operable within a system in which a security application 110 is operative, the primary function of which is different from symptom detection. User interaction with the security application 110 may generate user-health data 116 via a user input device 180 and/or a user monitoring device 182. For example, the at least one device 102, user-health test function unit 140 and/or user-health test function selection module 138 can apply at least one pupil movement test function to an interaction between a user 190 and a security application 110. The pupil movement test function may act in conjunction with the security application 110 to monitor the user's pupillary reflex, for example, within the parameters of the security application 110, or as an adjunct to actions within the security application 110. Examples of a security application 110 may include a password entry program, a code entry system, a biometric identification application, a video monitoring system, other body-part recognition means such as ear geometry detection, pupil spacing detection, or the like.

[0207] Operation 1006 depicts applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-imple-

mented biometric identification application, surveillance application, or code entry application. For example, at least one device 102 may be operable within a system in which a security application 110 is operative, the primary function of which is different from symptom detection. User interaction with the security application 110 may generate user-health data 116 via a user input device 180 and/or a user monitoring device 182. For example, the at least one device 102, user-health test function unit 140 and/or user-health test function selection module 138 can apply at least one pupil movement test function to an interaction between a user 190 and a security application 110 that authenticates a user's identity by matching retina patterns. The pupil movement test function may act in conjunction with the security application 110 to monitor the user's pupillary reflex, for example, within the parameters of the security application 110, or as an adjunct to actions within the security application 110.

[0208] Examples of a biometric identification application may include a fingerprint matching application, a facial feature matching application, a retina matching application, a voice pattern matching application, or the like. A biometric identification application includes identification functions, authentication functions, or the like, using personal characteristics as a reference against which identification or authentication may be measured. Examples of a surveillance application may include a video monitoring application, a voice detection application, or the like. Examples of a code entry application may include a mechanical or electronic lock requiring a code to unlock, a computerized security system requiring code entry for access or other functions, a software access feature requiring a code to access a program, or the like.

[0209] For example, a user 190 may interact with an eye imaging device in the course of using a retinal scanner. A device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply, for example, a pupil movement test function to the retinal scanner that, for example, detects pupil movement as a measure of the user's oculomotor nerve function, within the normal functioning of the retinal scanner.

[0210] In another embodiment, the at least one device 102 and/or user-health test function selection module 138 may, based on user-health data 116 indicative of a specific diagnosis, select a set of user-health test functions to apply. For example, as discussed above, a constellation of four kinds of altered user-health data 116 may indicate Gerstmann Syndrome; namely calculation deficit, right-left confusion, finger agnosia, and agraphia. Accordingly, the at least one device 102, user-health test function unit 140, and/or user-health test function selection module 138 may apply a group of user-health test functions to investigate the user's Gerstmann Syndrome profile, for example, if such symptoms are present in a user's medical history records. In this example, a system 100 may employ multiple user-health test functions in the context of multiple applications and/or devices. For example, a calculation test function may be applied in the context of a security application requiring a complex code for access to a program, object, or area; a neglect test function such as a right-left confusion test may be applied in the context of a security application that monitors user image data; and a speech test function or motor skill test function such as a finger agnosia test, agraphia, or writing test, may be applied in the context of an application 104 to complete the suite of test functions for Gerstmann's Syndrome.

[0211] FIG. 11 illustrates a partial view of an example computer program product 1100 that includes a computer program 1104 for executing a computer process on a computing device. An embodiment of the example computer program product 1100 is provided using a signal bearing medium 1102, and may include one or more instructions for obtaining user-health data; one or more instructions for selecting at least one user-health test function at least partly based on the user-health data; and one or more instructions for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection. The one or more instructions may be, for example, computer executable and/or logic-implemented instructions. In one implementation, the signal-bearing medium 1102 may include a computer-readable medium 1106. In one implementation, the signal bearing medium 1102 may include a recordable medium 1108. In one implementation, the signal bearing medium 1102 may include a communications medium 1110.

[0212] FIG. 12 illustrates an example system 1200 in which embodiments may be implemented. The system 1200 includes a computing system environment. The system 1200 also illustrates the user 190 using a device 1204, which is optionally shown as being in communication with a computing device 1202 by way of an optional coupling 1206. The optional coupling 1206 may represent a local, wide-area, or peer-to-peer network, or may represent a bus that is internal to a computing device (e.g., in example embodiments in which the computing device 1202 is contained in whole or in part within the device 1204). A storage medium 1208 may be any computer storage media.

[0213] The computing device 1202 includes computer-executable instructions 1210 that when executed on the computing device 1202 cause the computing device 1202 to (a) obtain user-health data; (b) select at least one user-health test function at least partly based on the user-health data; and (c) apply the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection. As referenced above and as shown in FIG. 12, in some examples, the computing device 1202 may optionally be contained in whole or in part within the device 1204.

[0214] In FIG. 12, then, the system 1200 includes at least one computing device (e.g., 1202 and/or 1204). The computer-executable instructions 1210 may be executed on one or more of the at least one computing device. For example, the computing device 1202 may implement the computer-executable instructions 1210 and output a result to (and/or receive data from) the computing device 1204. Since the computing device 1202 may be wholly or partially contained within the computing device 1204, the device 1204 also may be said to execute some or all of the computer-executable instructions 1210, in order to be caused to perform or implement, for example, various ones of the techniques described herein, or other techniques.

[0215] The device 1204 may include, for example, a portable computing device, workstation, or desktop computing device. In another example embodiment, the computing device 1202 is operable to communicate with the device 1204 associated with the user 190 to receive information about the input from the user 190 for performing data access and data processing and presenting an output of the user-health test

function at least partly based on the user data. Other examples of device 1204 may include one or more of a wearable computer, an implanted device, hearing aid or other personal health accessory device, a personal digital assistant (PDA), a personal entertainment device, a mobile phone, a laptop computer, a tablet personal computer, a networked computer, a computing system comprised of a cluster of processors, a computing system comprised of a cluster of servers.

[0216] Although a user 190 is shown/described herein as a single illustrated figure, those skilled in the art will appreciate that a user 190 may be representative of a human user, a robotic user (e.g., computational entity), and/or substantially any combination thereof (e.g., a user may be assisted by one or more robotic agents). In addition, a user 190, as set forth herein, although shown as a single entity may in fact be composed of two or more entities. Those skilled in the art will appreciate that, in general, the same may be said of "sender" and/or other entity-oriented terms as such terms are used herein.

[0217] One skilled in the art will recognize that the herein described components (e.g., steps), devices, and objects and the discussion accompanying them are used as examples for the sake of conceptual clarity and that various configuration modifications are within the skill of those in the art. Consequently, as used herein, the specific exemplars set forth and the accompanying discussion are intended to be representative of their more general classes. In general, use of any specific exemplar herein is also intended to be representative of its class, and the non-inclusion of such specific components (e.g., steps), devices, and objects herein should not be taken as indicating that limitation is desired.

[0218] Those skilled in the art will appreciate that the foregoing specific exemplary processes and/or devices and/or technologies are representative of more general processes and/or devices and/or technologies taught elsewhere herein, such as in the claims filed herewith and/or elsewhere in the present application.

[0219] Those having skill in the art will recognize that the state of the art has progressed to the point where there is little distinction left between hardware and software implementations of aspects of systems; the use of hardware or software is generally (but not always, in that in certain contexts the choice between hardware and software can become significant) a design choice representing cost vs. efficiency tradeoffs. Those having skill in the art will appreciate that there are various vehicles by which processes and/or systems and/or other technologies described herein can be effected (e.g., hardware, software, and/or firmware), and that the preferred vehicle will vary with the context in which the processes and/or systems and/or other technologies are deployed. For example, if an implementer determines that speed and accuracy are paramount, the implementer may opt for a mainly hardware and/or firmware vehicle; alternatively, if flexibility is paramount, the implementer may opt for a mainly software implementation; or, yet again alternatively, the implementer may opt for some combination of hardware, software, and/or firmware. Hence, there are several possible vehicles by which the processes and/or devices and/or other technologies described herein may be effected, none of which is inherently superior to the other in that any vehicle to be utilized is a choice dependent upon the context in which the vehicle will be deployed and the specific concerns (e.g., speed, flexibility, or predictability) of the implementer, any of which may vary. Those skilled in the art will recognize that

optical aspects of implementations will typically employ optically-oriented hardware, software, and or firmware.

[0220] The foregoing detailed description has set forth various embodiments of the devices and/or processes via the use of block diagrams, flowcharts, and/or examples. Insofar as such block diagrams, flowcharts, and/or examples contain one or more functions and/or operations, it will be understood by those within the art that each function and/or operation within such block diagrams, flowcharts, or examples can be implemented, individually and/or collectively, by a wide range of hardware, software, firmware, or virtually any combination thereof. In one embodiment, several portions of the subject matter described herein may be implemented via Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs), digital signal processors (DSPs), or other integrated formats. However, those skilled in the art will recognize that some aspects of the embodiments disclosed herein, in whole or in part, can be equivalently implemented in integrated circuits, as one or more computer programs running on one or more computers (e.g., as one or more programs running on one or more computer systems), as one or more programs running on one or more processors (e.g., as one or more programs running on one or more microprocessors), as firmware, or as virtually any combination thereof, and that designing the circuitry and/or writing the code for the software and or firmware would be well within the skill of one of skill in the art in light of this disclosure. In addition, those skilled in the art will appreciate that the mechanisms of the subject matter described herein are capable of being distributed as a program product in a variety of forms, and that an illustrative embodiment of the subject matter described herein applies regardless of the particular type of signal bearing medium used to actually carry out the distribution. Examples of a signal bearing medium include, but are not limited to, the following: a recordable type medium such as a floppy disk, a hard disk drive, a Compact Disc (CD), a Digital Video Disk (DVD), a digital tape, a computer memory, etc.; and a transmission type medium such as a digital and/or an analog communication medium (e.g., a fiber optic cable, a waveguide, a wired communications link, a wireless communication link, etc.).

[0221] In a general sense, those skilled in the art will recognize that the various aspects described herein which can be implemented, individually and/or collectively, by a wide range of hardware, software, firmware, or any combination thereof can be viewed as being composed of various types of "electrical circuitry." Consequently, as used herein "electrical circuitry" includes, but is not limited to, electrical circuitry having at least one discrete electrical circuit, electrical circuitry having at least one integrated circuit, electrical circuitry having at least one application specific integrated circuit, electrical circuitry forming a general purpose computing device configured by a computer program (e.g., a general purpose computer configured by a computer program which at least partially carries out processes and/or devices described herein, or a microprocessor configured by a computer program which at least partially carries out processes and/or devices described herein), electrical circuitry forming a memory device (e.g., forms of random access memory), and/or electrical circuitry forming a communications device (e.g., a modem, communications switch, or optical-electrical equipment). Those having skill in the art will recognize that the subject matter described herein may be implemented in an analog or digital fashion or some combination thereof.

[0222] Those skilled in the art will recognize that it is common within the art to describe devices and/or processes in the fashion set forth herein, and thereafter use engineering practices to integrate such described devices and/or processes into data processing systems. That is, at least a portion of the devices and/or processes described herein can be integrated into a data processing system via a reasonable amount of experimentation. Those having skill in the art will recognize that a typical data processing system generally includes one or more of a system unit housing, a video display device, a memory such as volatile and non-volatile memory, processors such as microprocessors and digital signal processors, computational entities such as operating systems, drivers, graphical user interfaces, and applications programs, one or more interaction devices, such as a touch pad or screen, and/or control systems including feedback loops and control motors (e.g., feedback for sensing position and/or velocity; control motors for moving and/or adjusting components and/or quantities). A typical data processing system may be implemented utilizing any suitable commercially available components, such as those typically found in data computing/communication and/or network computing/communication systems.

[0223] All of the above U.S. patents, U.S. patent application publications, U.S. patent applications, foreign patents, foreign patent applications and non-patent publications referred to in this specification and/or listed in any Application Data Sheet are incorporated herein by reference, to the extent not inconsistent herewith.

[0224] The herein described subject matter sometimes illustrates different components contained within, or connected with, different other components. It is to be understood that such depicted architectures are merely exemplary, and that in fact many other architectures can be implemented which achieve the same functionality. In a conceptual sense, any arrangement of components to achieve the same functionality is effectively "associated" such that the desired functionality is achieved. Hence, any two components herein combined to achieve a particular functionality can be seen as "associated with" each other such that the desired functionality is achieved, irrespective of architectures or intermedial components. Likewise, any two components so associated can also be viewed as being "operably connected", or "operably coupled," to each other to achieve the desired functionality, and any two components capable of being so associated can also be viewed as being "operably coupleable," to each other to achieve the desired functionality. Specific examples of operably coupleable include but are not limited to physically mateable and/or physically interacting components and/or wirelessly interactable and/or wirelessly interacting components and/or logically interacting and/or logically interactable components.

[0225] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations are not expressly set forth herein for sake of clarity.

[0226] While particular aspects of the present subject matter described herein have been shown and described, it will be apparent to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from the subject matter described herein and its broader aspects and, therefore, the appended claims are to

encompass within their scope all such changes and modifications as are within the true spirit and scope of the subject matter described herein. Furthermore, it is to be understood that the invention is defined by the appended claims. It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as “open” terms (e.g., the term “including” should be interpreted as “including but not limited to,” the term “having” should be interpreted as “having at least,” the term “includes” should be interpreted as “includes but is not limited to,” etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases “at least one” and “one or more” to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles “a” or “an” limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases “one or more” or “at least one” and indefinite articles such as “a” or “an” (e.g., “a” and/or “an” should typically be interpreted to mean “at least one” or “one or more”); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean at least the recited number (e.g., the bare recitation of “two recitations,” without other modifiers, typically means at least two recitations, or two or more recitations). Furthermore, in those instances where a convention analogous to “at least one of A, B, and C, etc.” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., “a system having at least one of A, B, and C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to “at least one of A, B, or C, etc.” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., “a system having at least one of A, B, or C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase “A or B” will be understood to include the possibilities of “A” or “B” or “A and B.”

[0227] With respect to the appended claims, those skilled in the art will appreciate that recited operations therein may generally be performed in any order. Examples of such alternate orderings may include overlapping, interleaved, interrupted, reordered, incremental, preparatory, supplemental, simultaneous, reverse, or other variant orderings, unless context dictates otherwise. With respect to context, even terms like “responsive to,” “related to,” or other past-tense adjectives

are generally not intended to exclude such variants, unless context dictates otherwise.

What is claimed is:

1. A method comprising:
 - obtaining user-health data;
 - selecting at least one user-health test function at least partly based on the user-health data; and
 - applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection.
2. The method of claim 1 wherein the obtaining user-health data comprises:
 - obtaining user health attribute data.
3. The method of claim 2 wherein the obtaining user health attribute data comprises:
 - obtaining user health condition data or user symptom data.
4. The method of claim 2 wherein the obtaining user health attribute data comprises:
 - obtaining user medication data or user nutraceutical data.
5. The method of claim 1 wherein the obtaining user-health data comprises:
 - obtaining user health measurement data.
- 6-7. (canceled)
8. The method of claim 1 wherein the obtaining user-health data comprises:
 - obtaining user health testing data.
9. The method of claim 8 wherein the obtaining user health testing data comprises:
 - obtaining user mental health testing data.
10. The method of claim 8 wherein the obtaining user health testing data comprises:
 - obtaining user physical health testing data.
11. The method of claim 1 wherein the obtaining user-health data comprises:
 - obtaining user-health test function output data.
- 12-17. (canceled)
18. The method of claim 1 wherein the selecting at least one user-health test function at least partly based on the user-health data comprises:
 - selecting at least one mental status test function.
19. The method of claim 1 wherein the selecting at least one user-health test function at least partly based on the user-health data comprises:
 - selecting at least one cranial nerve test function.
20. The method of claim 1 wherein the selecting at least one user-health test function at least partly based on the user-health data comprises:
 - selecting at least one cerebellum test function.
21. The method of claim 1 wherein the selecting at least one user-health test function at least partly based on the user-health data comprises:
 - selecting at least one of an alertness test function, an attention test function, a memory test function, a speech test function, a calculation test function, a neglect test function, a construction test function, or a task sequencing test function.
- 22-23. (canceled)
24. The method of claim 1 wherein the applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user input data.

25. The method of claim **1** wherein the applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user image data.

26. The method of claim **1** wherein the applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user pointing device manipulation data.

27. The method of claim **1** wherein the applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented game whose primary function is different from symptom detection.

28. The method of claim **1** wherein the applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented communications application whose primary function is different from symptom detection.

29. (canceled)

30. The method of claim **1** wherein the applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented productivity application whose primary function is different from symptom detection.

31. (canceled)

32. The method of claim **1** wherein the applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

applying the at least one user-health test function to the at least one interaction between the at least one user and at

least one device-implemented security application whose primary function is different from symptom detection.

33. (canceled)

34. A system comprising:

circuitry for obtaining user-health data;

circuitry for selecting at least one user-health test function at least partly based on the user-health data; and

circuitry for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection.

35. The system of claim **34** wherein the circuitry for obtaining user-health data comprises:

obtaining user health attribute data.

36. The system of claim **35** wherein the circuitry for obtaining user health attribute data comprises:

circuitry for obtaining user health condition data or user symptom data.

37. The system of claim **35** wherein the circuitry for obtaining user health attribute data comprises:

circuitry for obtaining user medication data or user nutritional data.

38. The system of claim **34** wherein the circuitry for obtaining user-health data comprises:

circuitry for obtaining user health measurement data.

39. The system of claim **38** wherein the circuitry for obtaining user health measurement data comprises:

circuitry for obtaining user cardiovascular measurement data.

40. The system of claim **38** wherein the circuitry for obtaining user health measurement data comprises:

circuitry for obtaining user respiratory measurement data.

41. The system of claim **34** wherein the circuitry for obtaining user-health data comprises:

circuitry for obtaining user health testing data.

42-43. (canceled)

44. The system of claim **34** wherein the circuitry for obtaining user-health data comprises:

circuitry for obtaining user-health test function output data.

45. The system of claim **44** wherein the circuitry for obtaining user-health test function output data comprises:

circuitry for obtaining mental status test function output data.

46. The system of claim **44** wherein the circuitry for obtaining user-health test function output data comprises:

circuitry for obtaining cranial nerve test function output data.

47. The system of claim **44** wherein the circuitry for obtaining user-health test function output data comprises:

circuitry for obtaining cerebellum test function output data.

48. The system of claim **44** wherein the circuitry for obtaining user-health test function output data comprises:

circuitry for obtaining alertness test function output data, attention test function output data, memory test function output data, speech test function output data, calculation test function output data, neglect test function output data, construction test function output data, or task sequencing test function output data.

49. The system of claim **44** wherein the circuitry for obtaining user-health test function output data comprises:

circuitry for obtaining visual field test function output data, eye movement test function output data, pupil move-

ment test function output data, face pattern test function output data, hearing test function output data, or voice test function output data.

50. The system of claim **44** wherein the circuitry for obtaining user-health test function output data comprises:

circuitry for obtaining body movement test function output data or motor skill test function output data.

51-54. (canceled)

55. The system of claim **34** wherein the circuitry for selecting at least one user-health test function at least partly based on the user-health data comprises:

circuitry for selecting at least one of a visual field test function, an eye movement test function, a pupil movement test function, a face pattern test function, a hearing test function, or a voice test function.

56. The system of claim **34** wherein the circuitry for selecting at least one user-health test function at least partly based on the user-health data comprises:

circuitry for selecting at least one of a body movement test function or a motor skill test function.

57. The system of claim **34** wherein the circuitry for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user input data.

58. The system of claim **34** wherein the circuitry for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user image data.

59. The system of claim **34** wherein the circuitry for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and the at least one device-implemented application whose primary function is different from symptom detection, the at least one interaction including user pointing device manipulation data.

60. The system of claim **34** wherein the circuitry for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented game whose primary function is different from symptom detection.

61. The system of claim **34** wherein the circuitry for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented communications application whose primary function is different from symptom detection.

62. The system of claim **61** wherein the circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented communications application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented email application, telephony application, or telecommunications application.

63. The system of claim **34** wherein the circuitry for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented productivity application whose primary function is different from symptom detection.

64. The system of claim **63** wherein the circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented productivity application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented word processing application, spreadsheet application, or presentation application.

65. The system of claim **34** wherein the circuitry for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented security application whose primary function is different from symptom detection.

66. The system of claim **65** wherein the circuitry for applying the at least one user-health test function to at least one interaction between the at least one user and at least one device-implemented security application whose primary function is different from symptom detection comprises:

circuitry for applying the at least one user-health test function to the at least one interaction between the at least one user and at least one device-implemented biometric identification application, surveillance application, or code entry application.

- 67.** A computer program product comprising:
a signal-bearing medium bearing
- (a) one or more instructions for obtaining user-health data;
 - (b) one or more instructions for selecting at least one user-health test function at least partly based on the user-health data; and
 - (c) one or more instructions for applying the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection.

68. The computer program product of claim **67**, wherein the signal-bearing medium includes a computer-readable medium.

69. The computer program product of claim **67**, wherein the signal-bearing medium includes a recordable medium.

70. The computer program product of claim **67**, wherein the signal-bearing medium includes a communications medium.

- 71.** A system comprising:
a computing device; and
instructions that when executed on the computing device cause the computing device to

- (a) obtain user-health data;
- (b) select at least one user-health test function at least partly based on the user-health data; and
- (c) apply the at least one user-health test function to at least one interaction between at least one user and at least one device-implemented application whose primary function is different from symptom detection.

72. The system of claim **71** wherein the computing device comprises:

- one or more of a wearable computer, an implanted device, a personal digital assistant (PDA), a personal entertainment device, a mobile phone, a laptop computer, a tablet personal computer, a networked computer, a computing system comprised of a cluster of processors, a computing system comprised of a cluster of servers, a workstation computer, and/or a desktop computer.

73. The system of claim **71** wherein the computing device is operable to obtain user data in response to the interaction between the user and the at least one application and select at least one user-health test function at least partly based on the user data from at least one memory.

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公开(公告)号	US20080243005A1	公开(公告)日	2008-10-02
申请号	US11/811865	申请日	2007-06-11
[标]申请(专利权)人(译)	特拉华州的SEARETE负债CORP		
申请(专利权)人(译)	SEARETE有限责任公司, 特拉华州的有限责任公司		
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摘要(译)

描述了执行获得用户健康数据的方法, 装置, 计算机程序产品, 设备和系统;至少部分地基于用户健康数据选择至少一个用户健康测试功能;将至少一个用户健康测试功能应用于至少一个用户与至少一个设备实现的应用程序之间的至少一个交互, 该应用程序的主要功能与症状检测不同。

