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Preston et al.

(54) GESTURE TO TRIGGER APPLICATION-PERTINENT INFORMATION

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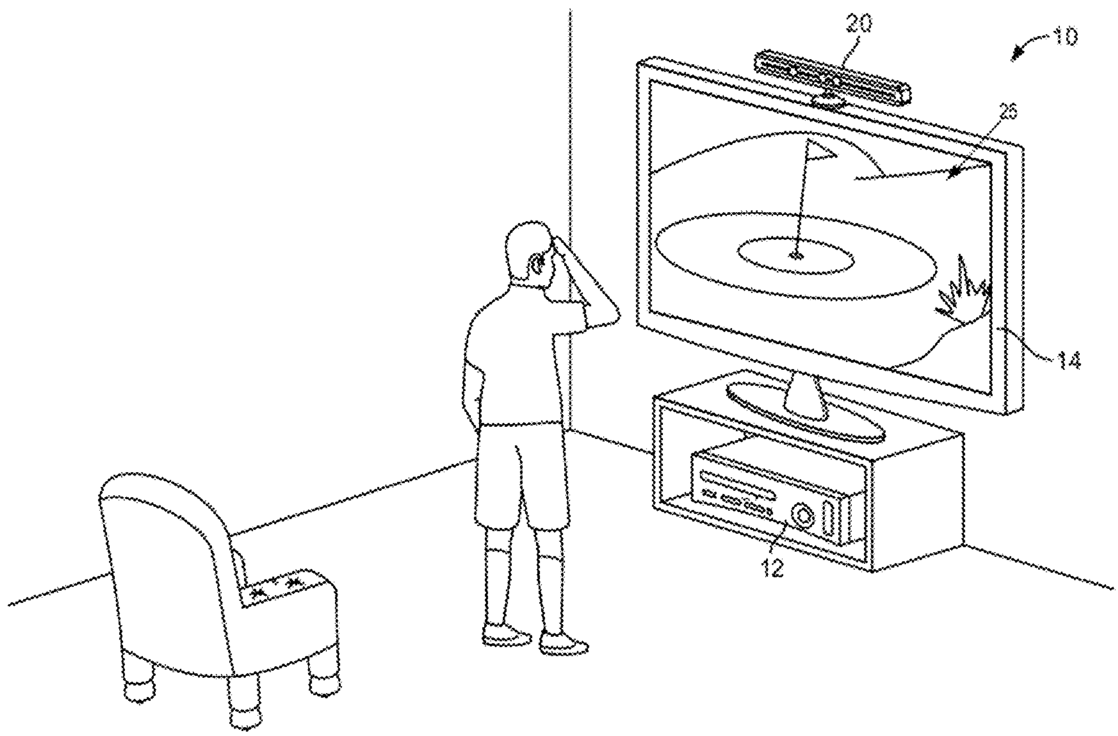
(57) **ABSTRACT**

A system is disclosed for interpreting a gesture which triggers application-pertinent information, such as altering a display to bring objects which are farther away into larger and clearer view. In one example, the application is a golfing game in which a user may perform a peer gesture which, when identified by the application, alters the view to display portions of a virtual golf hole nearer to a virtual green into larger and clearer view.



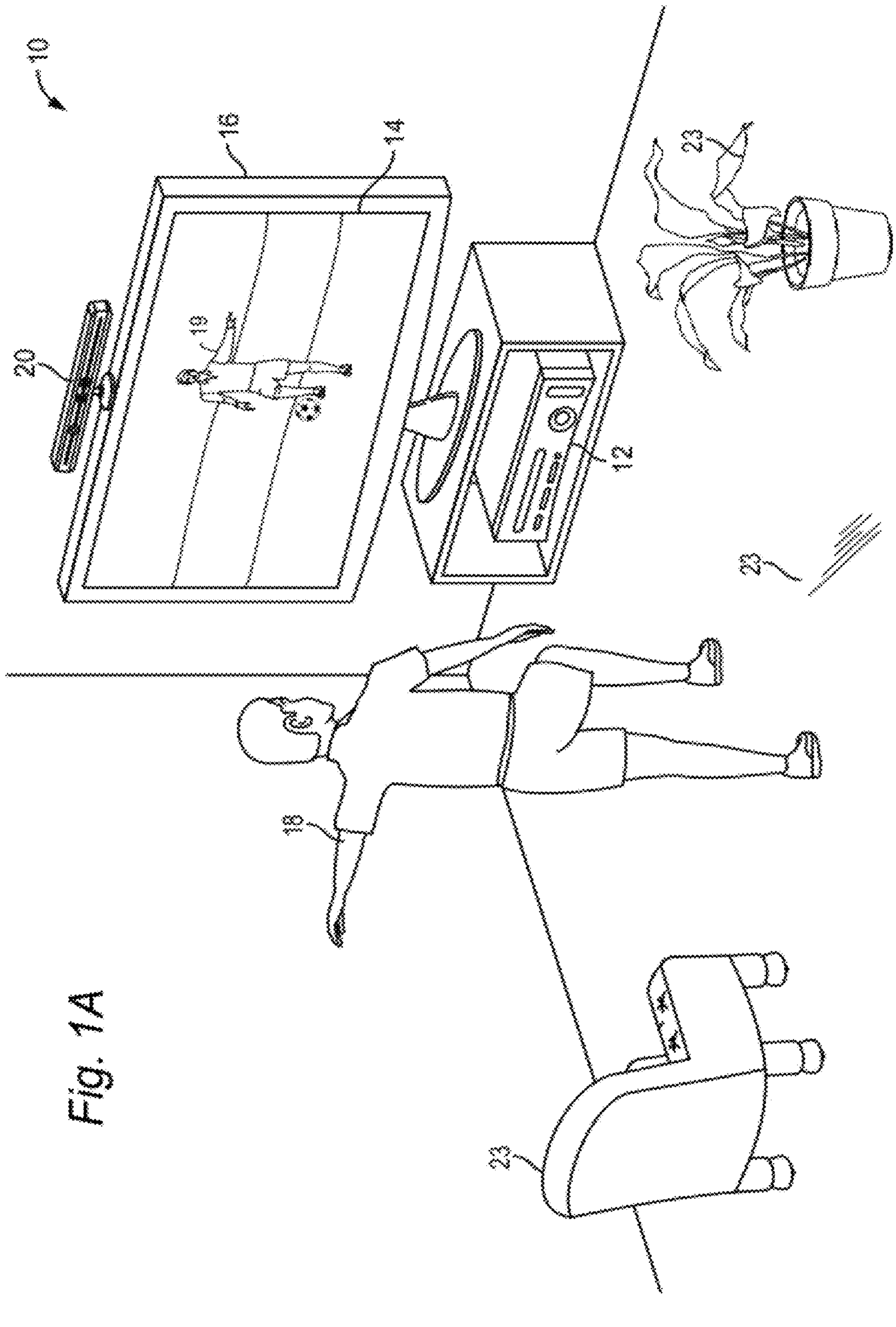


Fig. 1A

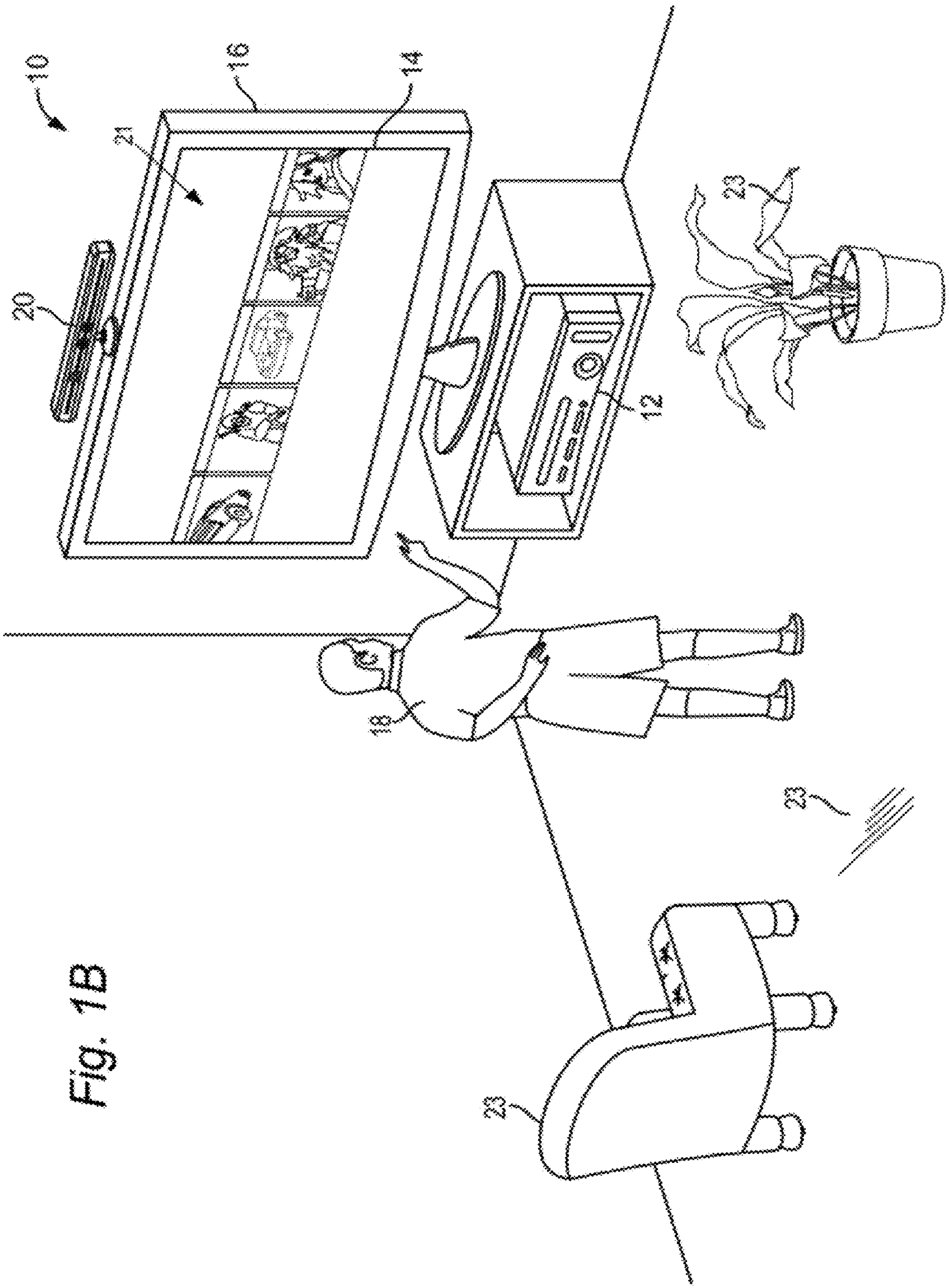


Fig. 1B

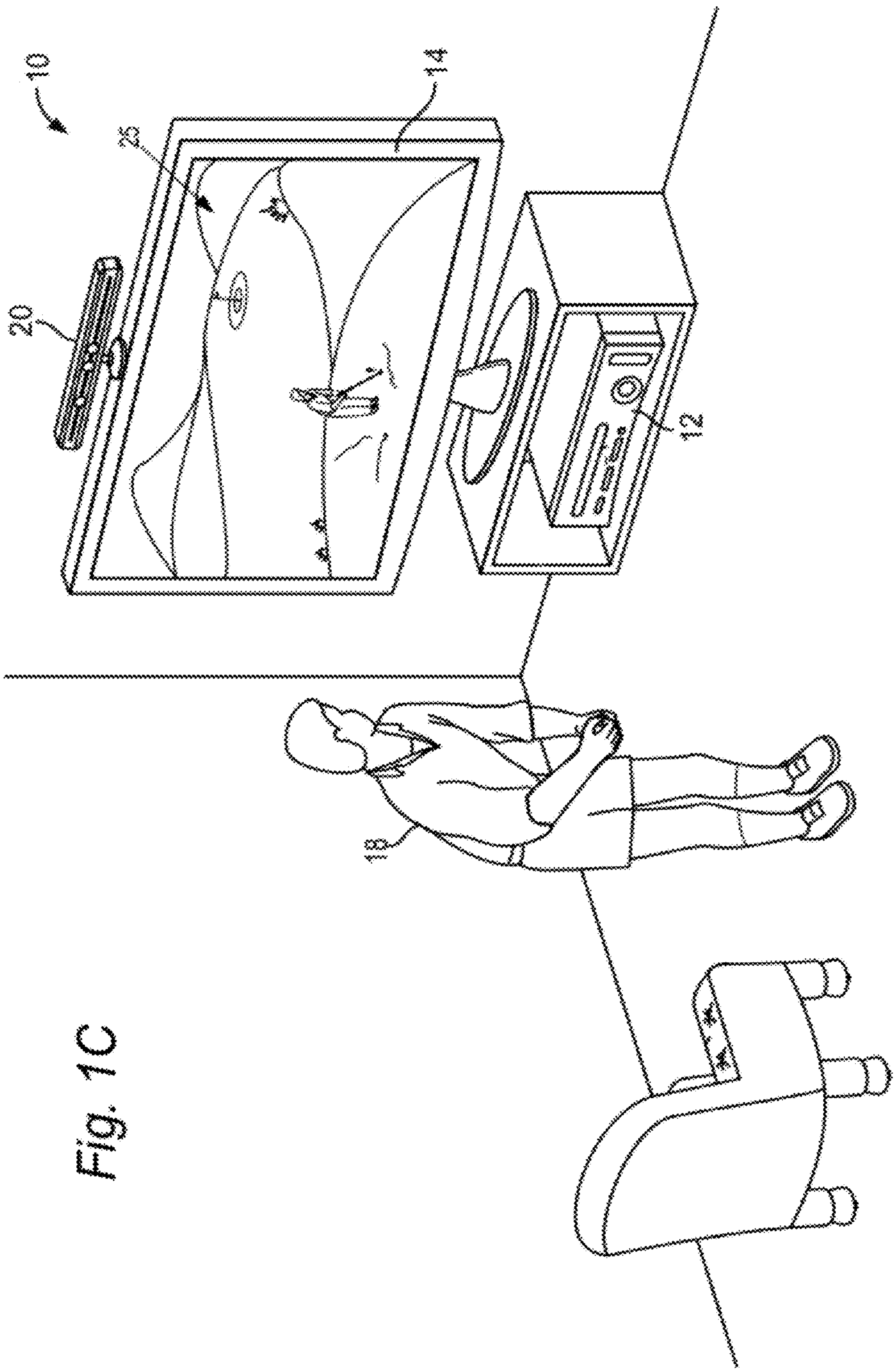


Fig. 1C

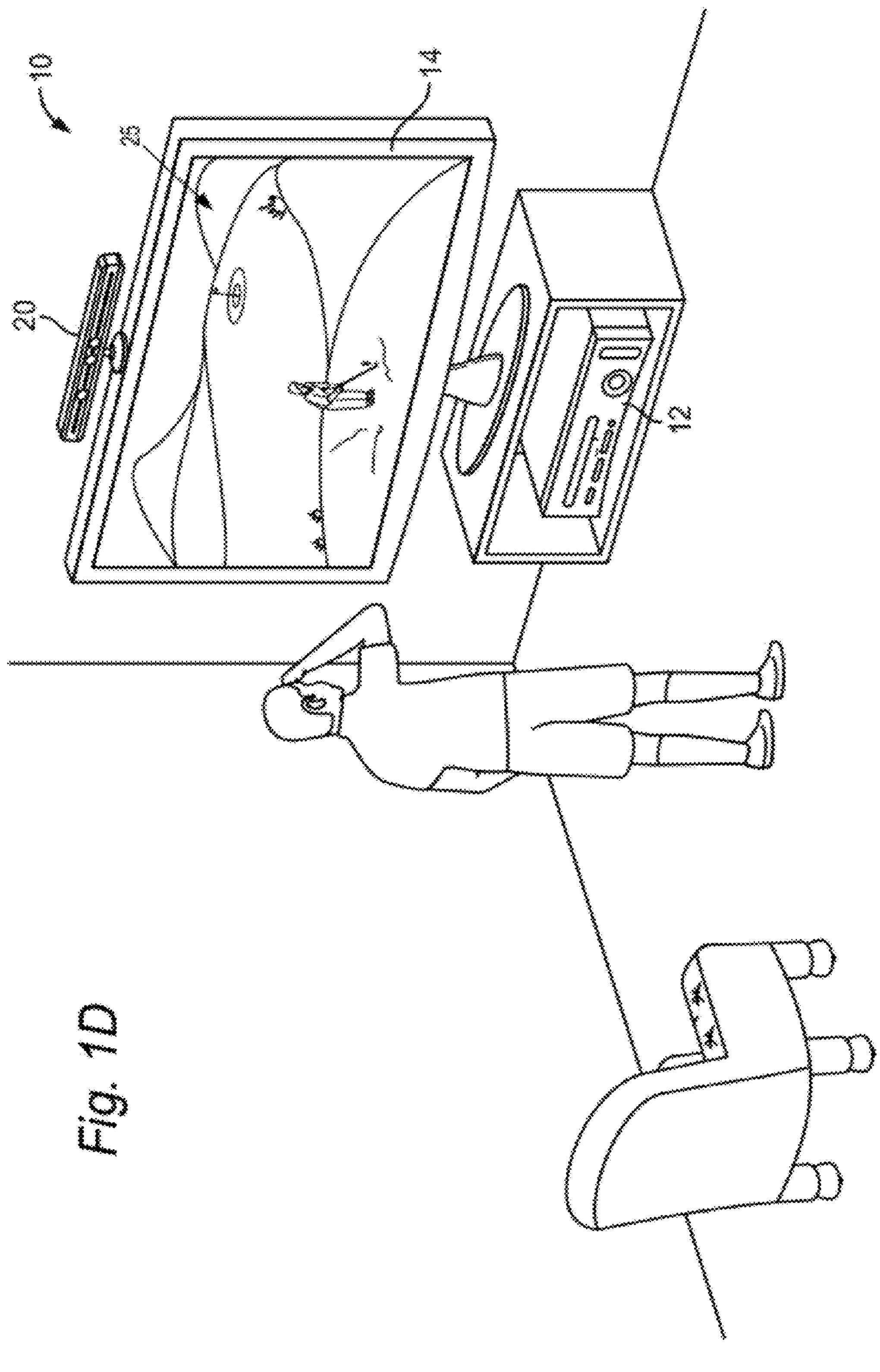


Fig. 1D

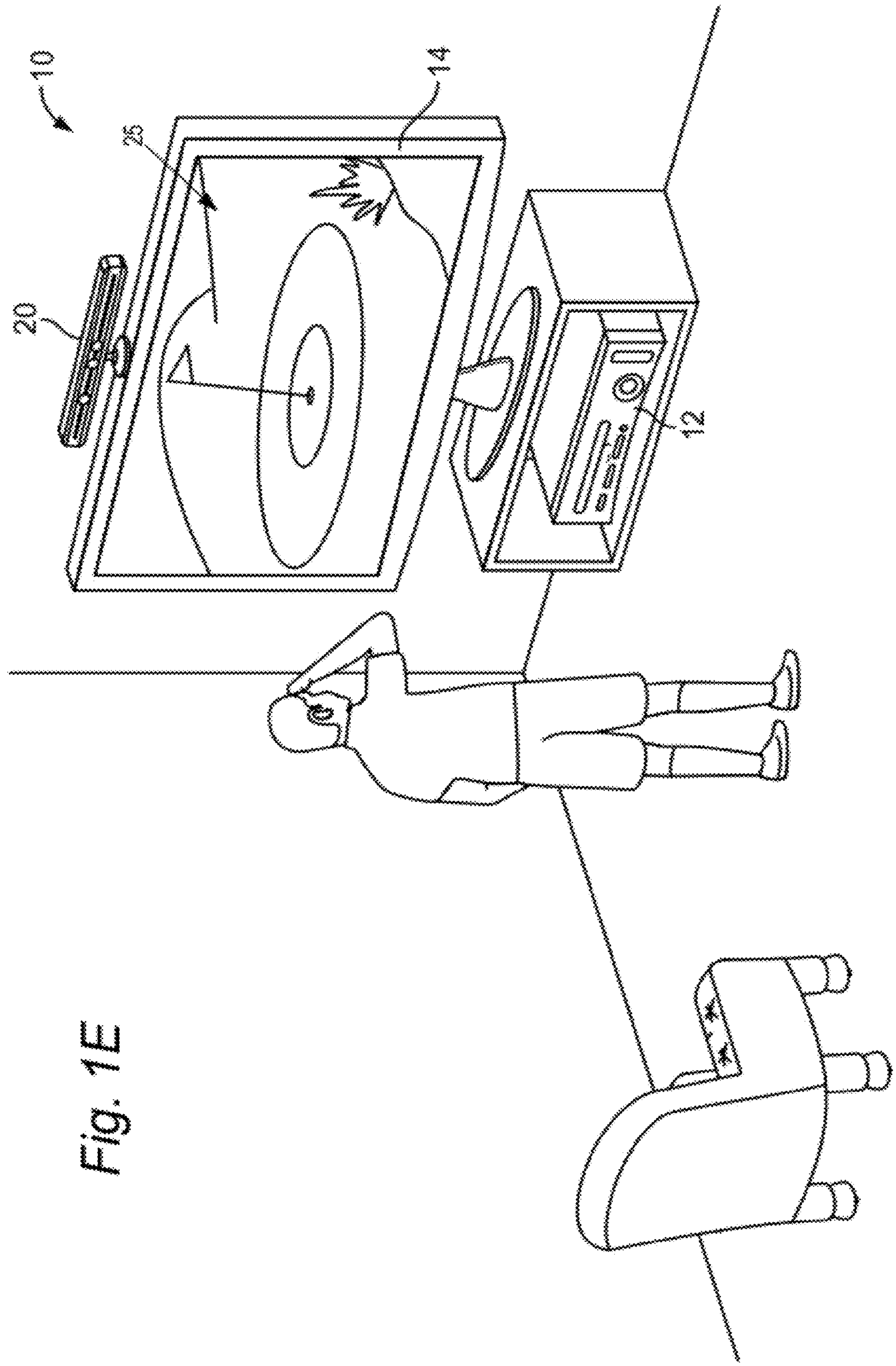


Fig. 1E

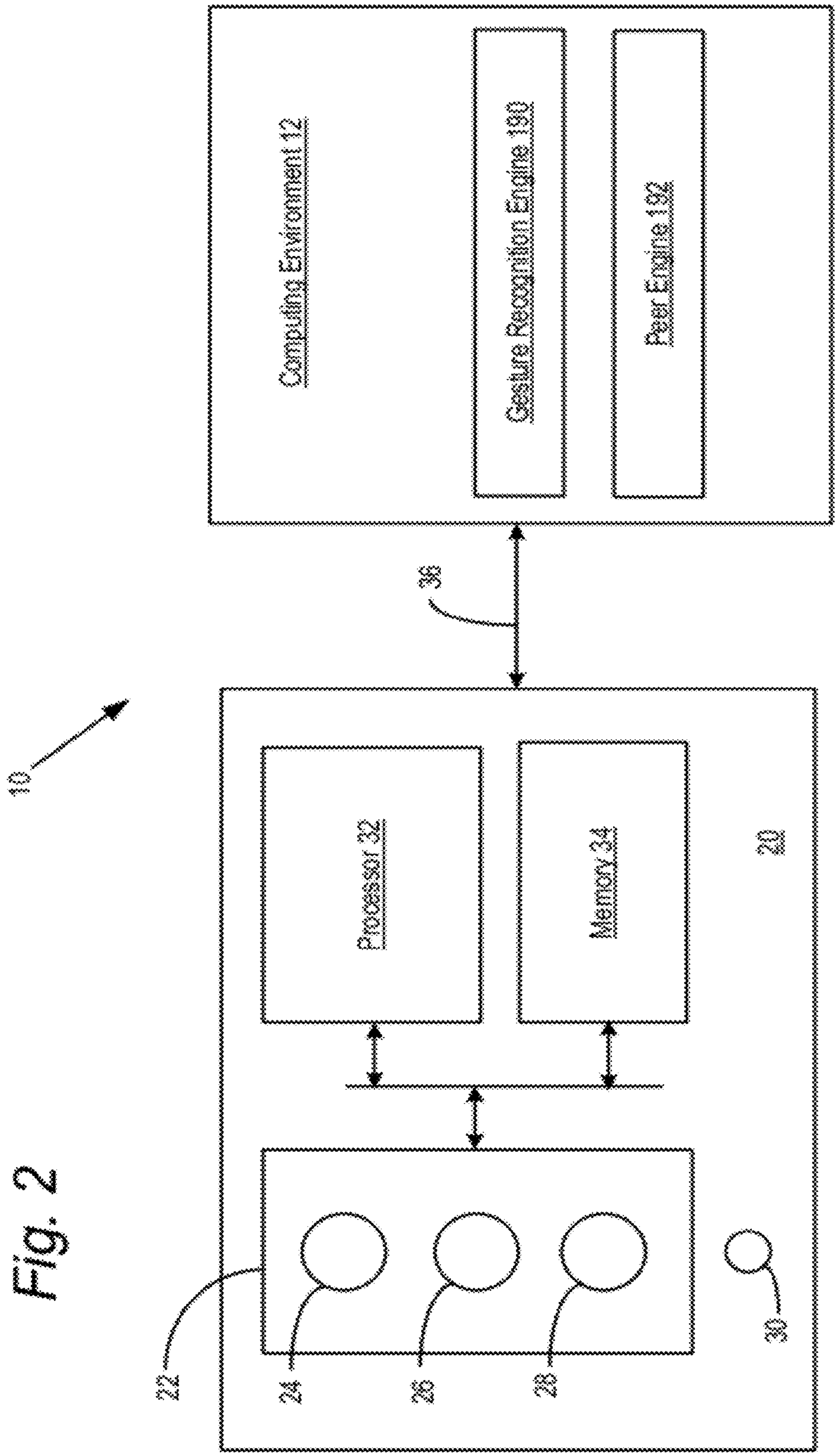

Computing Environment 12
Gesture Recognition Engine 190
Peer Engine 192
36
10
Processor 32
Memory 34
20
22
24
26
28
30

Fig. 2

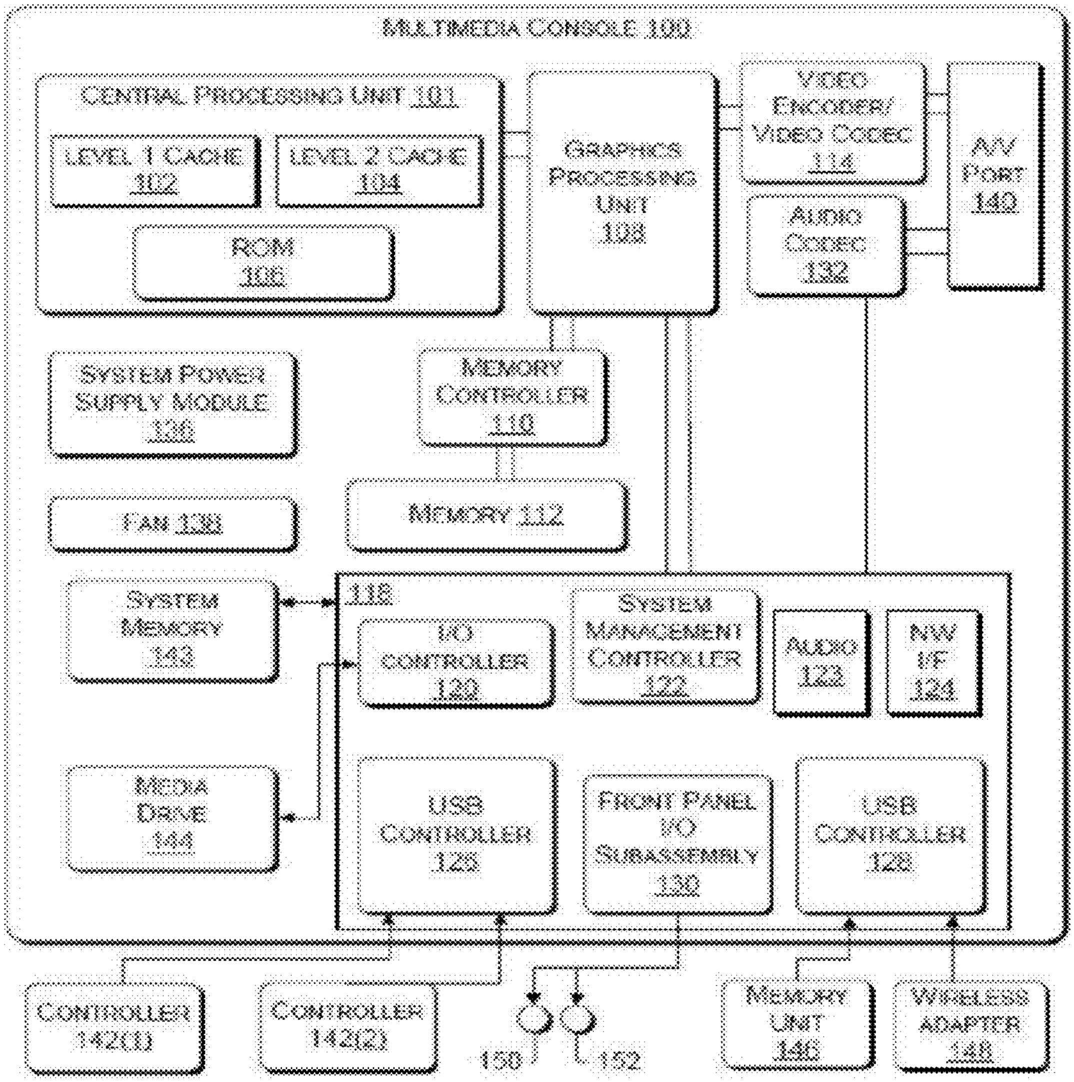

MULTIMEDIA CONSOLE 100
CENTRAL PROCESSING UNIT 101
LEVEL 1 CACHE 102
LEVEL 2 CACHE 104
ROM 106
GRAPHICS PROCESSING UNIT 108
VIDEO ENCODER/ VIDEO CODEC 114
AUDIO CODEC 132
A/V PORT 140
SYSTEM POWER SUPPLY MODULE 136
MEMORY CONTROLLER 110
FAN 138
MEMORY 112
SYSTEM MEMORY 143
118
I/O CONTROLLER 120
SYSTEM MANAGEMENT CONTROLLER 122
AUDIO 123
NW I/F 124
MEDIA DRIVE 144
USB CONTROLLER 126
FRONT PANEL I/O SUBASSEMBLY 130
USB CONTROLLER 128
CONTROLLER 142(1)
CONTROLLER 142(2)
150
152
MEMORY UNIT 146
WIRELESS ADAPTER 148

Fig. 3A

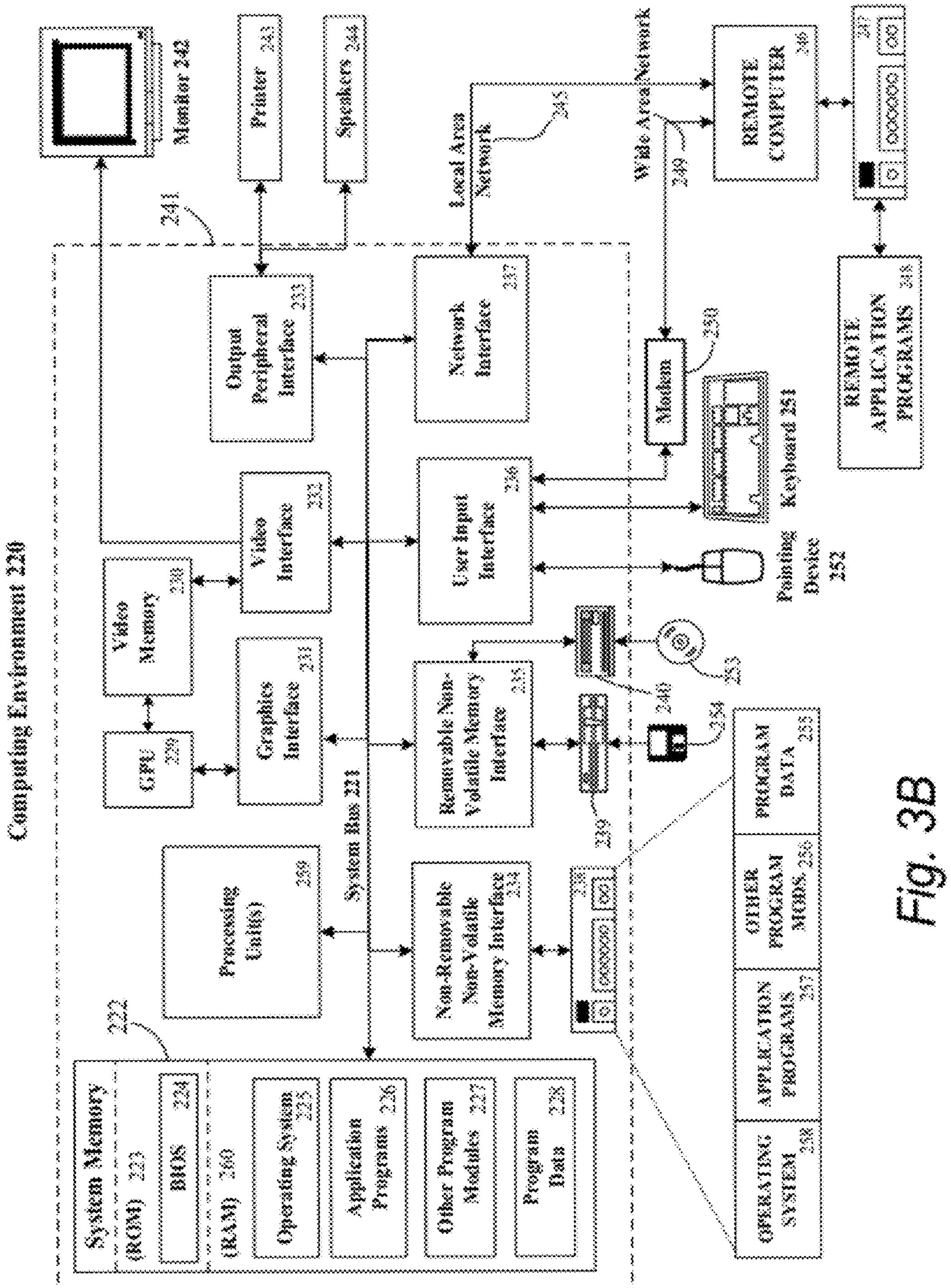

Computing Environment 220
System Memory 222
(ROM) 223
BIOS 224
(RAM) 260
Operating System 225
Application Programs 226
Other Program Modules 227
Program Data 228
Processing Unit(s) 259
System Bus 221
Non-Removable Non-Volatile Memory Interface 234
Removable Non-Volatile Memory Interface 235
GPU 229
Graphics Interface 231
Video Memory 230
Video Interface 232
User Input Interface 236
Output Peripheral Interface 233
Network Interface 237
Monitor 242
Printer 243
Speakers 244
241
Local Area Network
245
Wide Area Network
249
Modem 250
Keyboard 251
Pointing Device 252
REMOTE COMPUTER 246
247
REMOTE APPLICATION PROGRAMS 248
238
239
240
253
254
OPERATING SYSTEM 258
APPLICATION PROGRAMS 257
OTHER PROGRAM MODS. 256
PROGRAM DATA 255

Fig. 3B

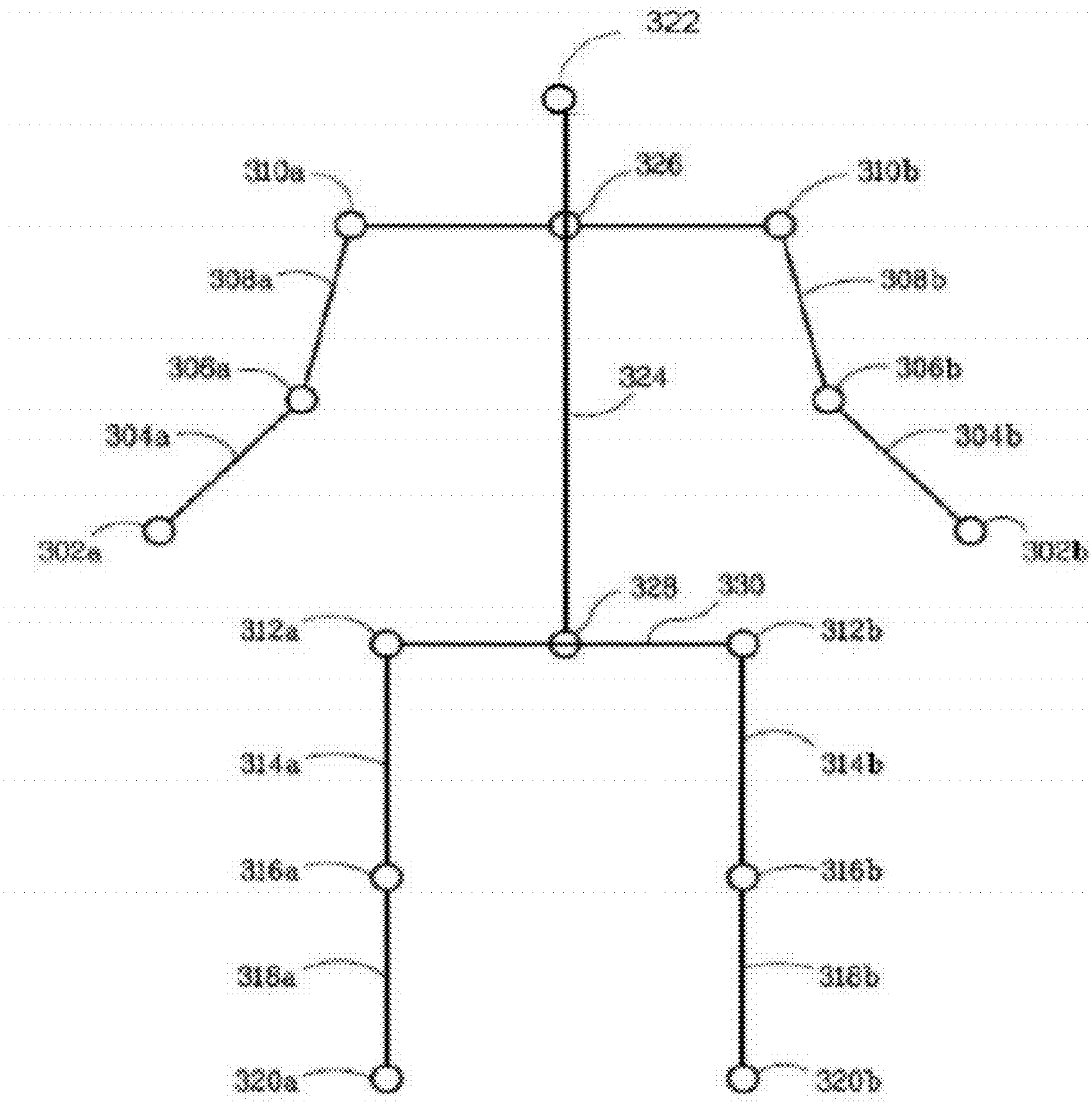
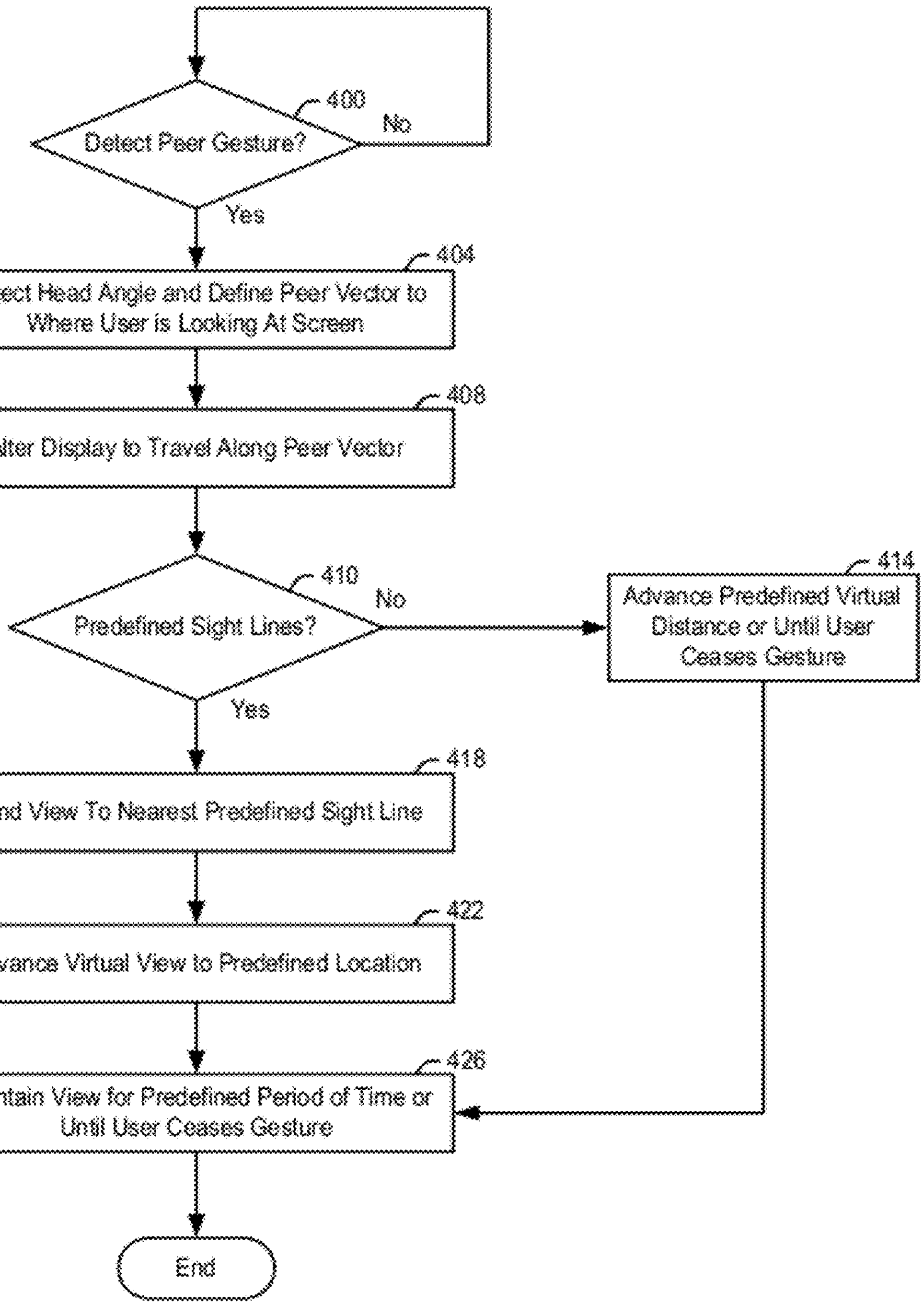

322
310a
326
310b
308a
308b
306a
324
306b
304a
304b
302a
302b
328
330
312a
312b
314a
314b
316a
316b
318a
318b
320a
320b

Fig. 4

Fig. 5



400
Detect Peer Gesture?
No
Yes
404
Detect Head Angle and Define Peer Vector to Where User is Looking At Screen
408
Alter Display to Travel Along Peer Vector
410
Predefined Sight Lines?
No
Yes
414
Advance Predefined Virtual Distance or Until User Ceases Gesture
418
Bend View To Nearest Predefined Sight Line
422
Advance Virtual View to Predefined Location
426
Maintain View for Predefined Period of Time or Until User Ceases Gesture
End

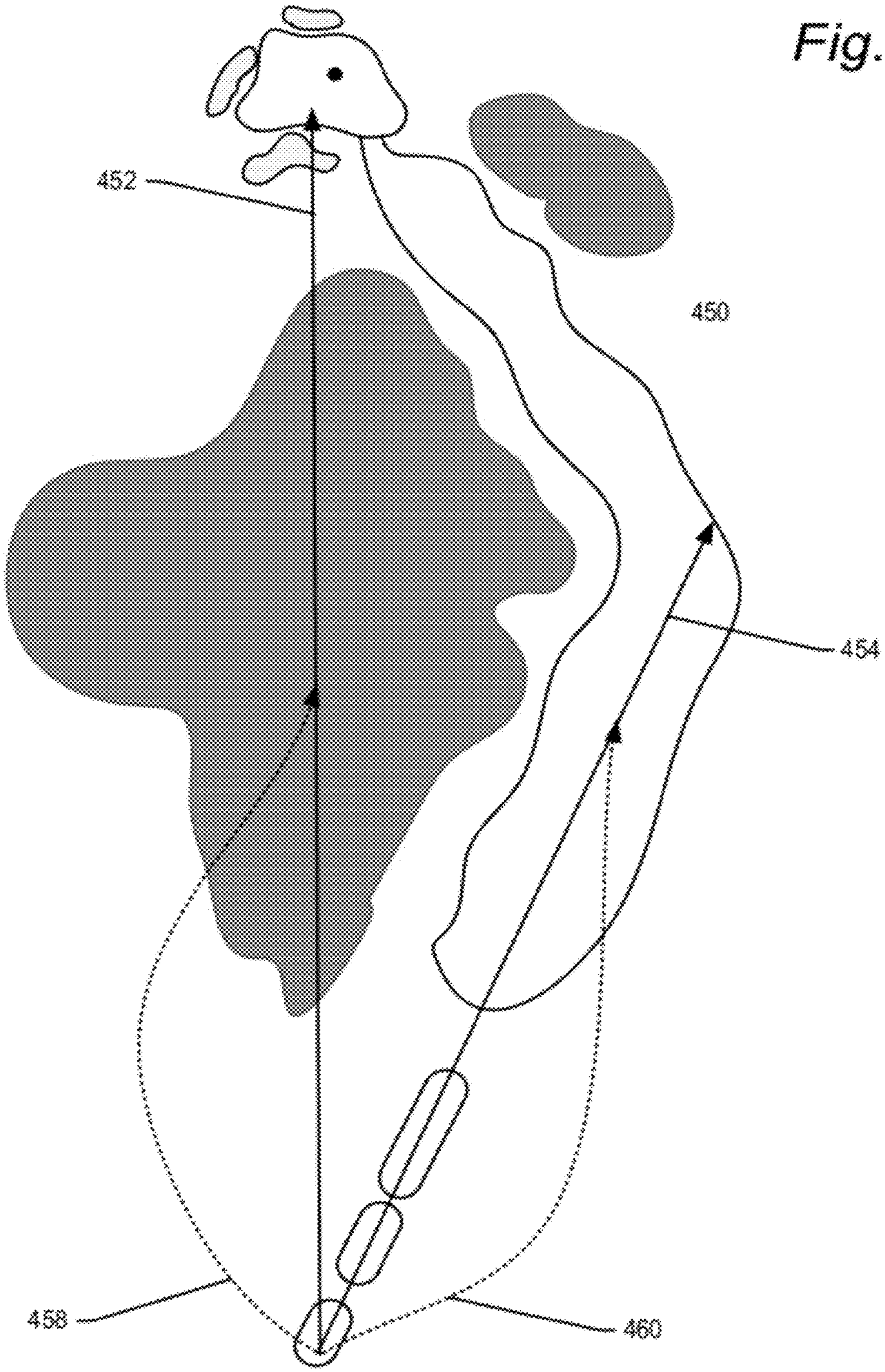


Fig. 6

Fig. 7

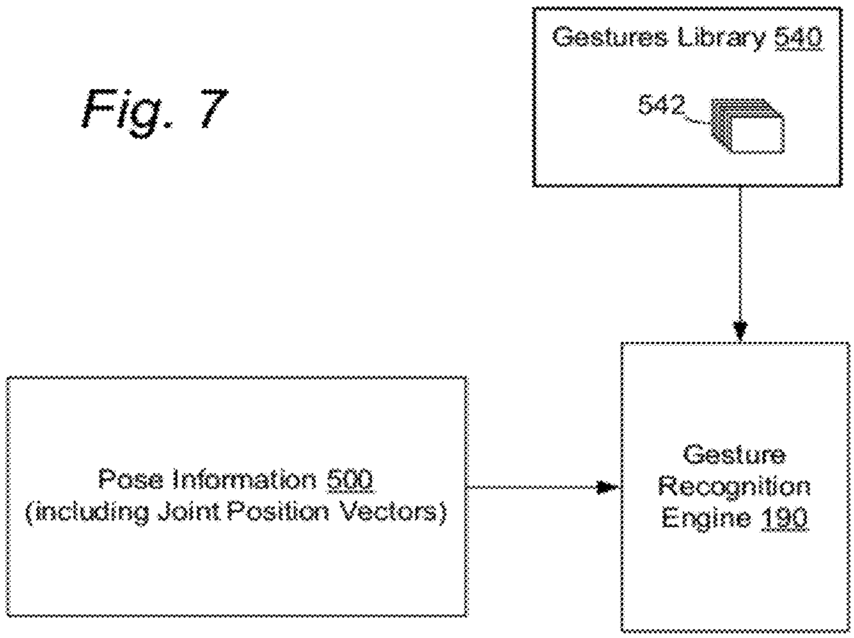
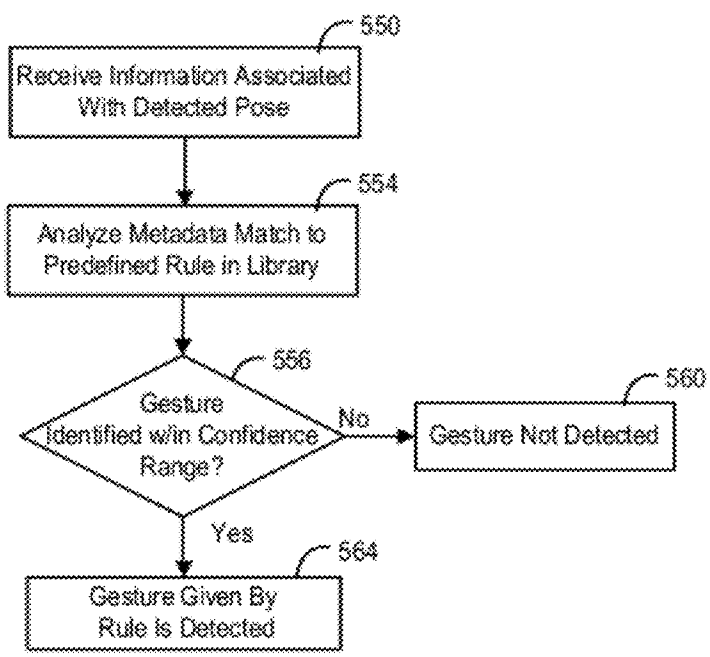

Gestures Library 540
542
Pose Information 500
(including Joint Position Vectors)
Gesture
Recognition
Engine 190

Fig. 8


550
Receive Information Associated
With Detected Pose
554
Analyze Metadata Match to
Predefined Rule in Library
556
Gesture
Identified w/in Confidence
Range?
No
560
Gesture Not Detected
Yes
564
Gesture Given By
Rule Is Detected

GESTURE TO TRIGGER APPLICATION-PERTINENT INFORMATION

CLAIM OF PRIORITY

[0001] The present application claims priority to U.S. Provisional Patent Application No. 61/493,687, entitled "Gesture to Trigger Application-Pertinent Information," filed Jun. 6, 2011, which application is incorporated by reference herein in its entirety.

BACKGROUND

[0002] In the past, computing applications such as computer games and multimedia applications used controls to allow users to manipulate game characters or other aspects of an application. Typically such controls are input using, for example, controllers, remotes, keyboards, mice, or the like. More recently, computer games and multimedia applications have begun employing cameras and software gesture recognition engines to provide a natural user interface ("NUI"). With a NUI interface, user gestures are detected, interpreted and used to control game characters or other aspects of an application.

[0003] It may be desirable for a user of a graphical user interface such as a NUI system to peer off into the distance. For example, in a golfing game application, a user may wish to see down the fairway and get a closer look at the green.

SUMMARY

[0004] The present technology in general relates to a gesture triggering application pertinent information, such as altering a display to bring objects which are farther away into larger and clearer view.

[0005] In one example, the present technology relates to a method for implementing a peer gesture via a natural user interface, comprising: (a) determining if a user has performed a predefined gesture relating to peering into a virtual distance with respect to a scene displayed on a display; and (b) changing the display to create the impression of peering into the virtual distance of the scene displayed on the display upon determining that the user has performed the predefined peering gesture in said step (a).

[0006] In another example, the present technology relates to a system for implementing a peer gesture via a natural user interface, comprising: a display for displaying a virtual three-dimensional scene; and a computing device for executing an application, the application generating the virtual three-dimensional scene on the display, and the application including a peer gesture software engine for receiving an indication of a predefined peer gesture, and for causing a view of the three-dimensional scene to change by moving along a path from a first perspective displaying a first point to a second perspective displaying a second point which is virtually distal from the first point.

[0007] In a further example, the present technology relates to a processor-readable storage media having processor-readable code embodied on said processor-readable storage media, said processor readable code for programming one or more processors of a hand-held mobile device to perform a method comprising: (a) designing a three-dimensional view of a virtual golf hole in a golf gaming application; (b) determining if a user has performed a predefined gesture relating to peering into a virtual distance with respect to the virtual golf hole displayed on a display; and (c) changing the view of the virtual golf hole by moving along a path from a first point in the foreground of a view to a second point at or nearer to a virtual green of the virtual golf hole to show the second point at or nearer to the virtual green in greater detail.

[0008] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIGS. **1**A-**1**E illustrate example embodiments of a target recognition, analysis, and tracking system with a user playing a game.

[0010] FIG. **2** illustrates an example embodiment of a capture device that may be used in a target recognition, analysis, and tracking system.

[0011] FIG. **3**A illustrates an example embodiment of a computing environment that may be used to interpret one or more gestures in a target recognition, analysis, and tracking system.

[0012] FIG. **3**B illustrates another example embodiment of a computing environment that may be used to interpret one or more gestures in a target recognition, analysis, and tracking system.

[0013] FIG. **4** illustrates a skeletal mapping of a user that has been generated from the target recognition, analysis, and tracking system of FIG. **2**.

[0014] FIG. **5** is a flowchart of the operation of an embodiment of the present disclosure.

[0015] FIG. **6** illustrates sight lines for peering into the distance according to embodiments of the present disclosure.

[0016] FIG. **7** is a block diagram showing a gesture recognition engine for determining whether pose information matches a stored gesture.

[0017] FIG. **8** is a flowchart showing the operation of the gesture recognition engine.

DETAILED DESCRIPTION

[0018] Embodiments of the present technology will now be described with reference to FIGS. **1**A-**8**, which in general relate to a system interpreting a gesture triggering application pertinent information, such as altering a display to bring objects which are farther away into larger and clearer view. Embodiments are described below respect to a golf gaming application. However, the system of the present disclosure can be used in a variety of other gaming and multimedia applications where it may be desirable to view displayed objects that are in the distance more clearly.

[0019] Referring initially to FIGS. **1**A-**2**, the hardware for implementing the present technology includes a target recognition, analysis, and tracking system **10** which may be used to recognize, analyze, and/or track a human target such as the user **18**. Embodiments of the target recognition, analysis, and tracking system **10** include a computing environment **12** for executing a gaming or other application. The computing environment **12** may include hardware components and/or software components such that computing environment **12** may be used to execute applications such as gaming and nongaming applications. In one embodiment, computing environment **12** may include a processor such as a standardized processor, a specialized processor, a microprocessor, or the like that may execute instructions stored on a processor readable storage device for performing processes described herein.

[0020] The system **10** further includes a capture device **20** for capturing image and audio data relating to one or more users and/or objects sensed by the capture device. In embodiments, the capture device **20** may be used to capture information relating to body and hand movements and/or gestures and speech of one or more users, which information is received by the computing environment and used to render, interact with and/or control aspects of a gaming or other application. Examples of the computing environment **12** and capture device **20** are explained in greater detail below.

[0021] Embodiments of the target recognition, analysis and tracking system **10** may be connected to an audio/visual (A/V) device **16** having a display **14**. The device **16** may for example be a television, a monitor, a high-definition television (HDTV), or the like that may provide game or application visuals and/or audio to a user. For example, the computing environment **12** may include a video adapter such as a graphics card and/or an audio adapter such as a sound card that may provide audio/visual signals associated with the game or other application. The A/V device **16** may receive the audio/visual signals from the computing environment **12** and may then output the game or application visuals and/or audio associated with the audio/visual signals to the user **18**. According to one embodiment, the audio/visual device **16** may be connected to the computing environment **12** via, for example, an S-Video cable, a coaxial cable, an HDMI cable, a DVI cable, a VGA cable, a component video cable, or the like.

[0022] In embodiments, the computing environment **12**, the A/V device **16** and the capture device **20** may cooperate to render an avatar or on-screen character **19** on display **14**. For example, FIG. **1**A shows a user **18** playing a soccer gaming application. The user's movements are tracked and used to animate the movements of the avatar **19**. In embodiments, the avatar **19** mimics the movements of the user **18** in real world space so that the user **18** may perform movements and gestures which control the movements and actions of the avatar **19** on the display **14**. In FIG. **1**B, the capture device **20** is used in a NUI system where, for example, a user **18** is scrolling through and controlling a user interface **21** with a variety of menu options presented on the display **14**. In FIG. **1**B, the computing environment **12** and the capture device **20** may be used to recognize and analyze movements and gestures of a user's body, and such movements and gestures may be interpreted as controls for the user interface.

[0023] FIG. **1**C illustrates a user **18** playing a golfing game running on computing environment **12**. The onscreen avatar **19** tracks and mirrors a user's movements. A display of a virtual golf hole is displayed on display **14**. As a user is playing the golfing game, he or she may desire to peer into the distance. For example, the user may wish to get a closer, clearer look at the green, or a portion of the hole that is off in the distance.

[0024] In accordance with the present disclosure, the user may perform a predefined gesture, referred to herein as a peer gesture. An example of a peer gesture is shown in FIG. **1**D. In this example, the user cups his or her eyes with his or her hand, though it is understood that other gestures may be used as the peer gesture in further embodiments. As shown in FIG. **1**E, upon performing the gesture, the display zooms into the distance, enlarging a view of objects or things in the distance and making them more clear.

[0025] Suitable examples of a system **10** and components thereof are found in the following co-pending patent applications, all of which are hereby specifically incorporated by reference: U.S. patent application Ser. No. 12/475,094, entitled "Environment and/or Target Segmentation," filed May 29, 2009; U.S. patent application Ser. No. 12/511,850, entitled "Auto Generating a Visual Representation," filed Jul. 29, 2009; U.S. patent application Ser. No. 12/474,655, entitled "Gesture Tool," filed May 29, 2009; U.S. patent application Ser. No. 12/603,437, entitled "Pose Tracking Pipeline," filed Oct. 21, 2009; U.S. patent application Ser. No. 12/475,308, entitled "Device for Identifying and Tracking Multiple Humans Over Time," filed May 29, 2009, U.S. patent application Ser. No. 12/575,388, entitled "Human Tracking System," filed Oct. 7, 2009; U.S. patent application Ser. No. 12/422,661, entitled "Gesture Recognizer System Architecture," filed Apr. 13, 2009; U.S. patent application Ser. No. 12/391,150, entitled "Standard Gestures," filed Feb. 23, 2009; and U.S. patent application Ser. No. 12/474,655, entitled "Gesture Tool," filed May 29, 2009.

[0026] FIG. **2** illustrates an example embodiment of the capture device **20** that may be used in the target recognition, analysis, and tracking system **10**. In an example embodiment, the capture device **20** may be configured to capture video having a depth image that may include depth values via any suitable technique including, for example, time-of-flight, structured light, stereo image, or the like. According to one embodiment, the capture device **20** may organize the calculated depth information into "Z layers," or layers that may be perpendicular to a Z axis extending from the depth camera along its line of sight. X and Y axes may be defined as being perpendicular to the Z axis. The Y axis may be vertical and the X axis may be horizontal. Together, the X, Y and Z axes define the 3-D real world space captured by capture device **20**.

[0027] As shown in FIG. **2**, the capture device **20** may include an image camera component **22**. According to an example embodiment, the image camera component **22** may be a depth camera that may capture the depth image of a scene. The depth image may include a two-dimensional (2-D) pixel area of the captured scene where each pixel in the 2-D pixel area may represent a depth value such as a length or distance in, for example, centimeters, millimeters, or the like of an object in the captured scene from the camera.

[0028] As shown in FIG. **2**, according to an example embodiment, the image camera component **22** may include an IR light component **24**, a three-dimensional (3-D) camera **26**, and an RGB camera **28** that may be used to capture the depth image of a scene. For example, in time-of-flight analysis, the IR light component **24** of the capture device **20** may emit an infrared light onto the scene and may then use sensors (not shown) to detect the backscattered light from the surface of one or more targets and objects in the scene using, for example, the 3-D camera **26** and/or the RGB camera **28**.

[0029] In some embodiments, pulsed infrared light may be used such that the time between an outgoing light pulse and a corresponding incoming light pulse may be measured and used to determine a physical distance from the capture device **20** to a particular location on the targets or objects in the scene. Additionally, in other example embodiments, the phase of the outgoing light wave may be compared to the phase of the incoming light wave to determine a phase shift. The phase shift may then be used to determine a physical distance from the capture device **20** to a particular location on the targets or objects.

[0030] According to another example embodiment, time-of-flight analysis may be used to indirectly determine a physical distance from the capture device **20** to a particular location on the targets or objects by analyzing the intensity of the reflected beam of light over time via various techniques including, for example, shuttered light pulse imaging.

[0031] In another example embodiment, the capture device **20** may use a structured light to capture depth information. In such an analysis, patterned light (i.e., light displayed as a known pattern such as a grid pattern or a stripe pattern) may be projected onto the scene via, for example, the IR light component **24**. Upon striking the surface of one or more targets or objects in the scene, the pattern may become deformed in response. Such a deformation of the pattern may be captured by, for example, the 3-D camera **26** and/or the RGB camera **28** and may then be analyzed to determine a physical distance from the capture device **20** to a particular location on the targets or objects.

[0032] According to another embodiment, the capture device **20** may include two or more physically separated cameras that may view a scene from different angles, to obtain visual stereo data that may be resolved to generate depth information. In another example embodiment, the capture device **20** may use point cloud data and target digitization techniques to detect features of the user.

[0033] The capture device **20** may further include a microphone **30**. The microphone **30** may include a transducer or sensor that may receive and convert sound into an electrical signal. According to one embodiment, the microphone **30** may be used to reduce feedback between the capture device **20** and the computing environment **12** in the target recognition, analysis, and tracking system **10**. Additionally, the microphone **30** may be used to receive audio signals that may also be provided by the user to control applications such as game applications, non-game applications, or the like that may be executed by the computing environment **12**.

[0034] In an example embodiment, the capture device **20** may further include a processor **32** that may be in operative communication with the image camera component **22**. The processor **32** may include a standardized processor, a specialized processor, a microprocessor, or the like that may execute instructions that may include instructions for receiving the depth image, determining whether a suitable target may be included in the depth image, converting the suitable target into a skeletal representation or model of the target, or any other suitable instruction.

[0035] The capture device **20** may further include a memory component **34** that may store the instructions that may be executed by the processor **32**, images or frames of images captured by the 3-D camera or RGB camera, or any other suitable information, images, or the like. According to an example embodiment, the memory component **34** may include random access memory (RAM), read only memory (ROM), cache, Flash memory, a hard disk, or any other suitable storage component. As shown in FIG. **2**, in one embodiment, the memory component **34** may be a separate component in communication with the image camera component **22** and the processor **32**. According to another embodiment, the memory component **34** may be integrated into the processor **32** and/or the image camera component **22**.

[0036] As shown in FIG. **2**, the capture device **20** may be in communication with the computing environment **12** via a communication link **36**. The communication link **36** may be a wired connection including, for example, a USB connection, a Firewire connection, an Ethernet cable connection, or the like and/or a wireless connection such as a wireless 802.11b, g, a, or n connection. According to one embodiment, the computing environment **12** may provide a clock to the capture device **20** that may be used to determine when to capture, for example, a scene via the communication link **36**.

[0037] Additionally, the capture device **20** may provide the depth information and images captured by, for example, the 3-D camera **26** and/or the RGB camera **28**. With the aid of these devices, a partial skeletal model may be developed in accordance with the present technology, with the resulting data provided to the computing environment **12** via the communication link **36**.

[0038] The computing environment **12** may further include a gesture recognition engine **190** for recognizing gestures, such as the peer gesture as explained above and below. In accordance with the present system, the computing environment **12** may further include a peer engine **192** as explained below.

[0039] FIG. **3**A illustrates an example embodiment of a computing environment that may be used to interpret one or more gestures in a target recognition, analysis, and tracking system. The computing environment such as the computing environment **12** described above with respect to FIGS. **1**A-**2** may be a multimedia console **100**, such as a gaming console. As shown in FIG. **3**A, the multimedia console **100** has a central processing unit (CPU) **101** having a level 1 cache **102**, a level 2 cache **104**, and a flash ROM **106**. The level 1 cache **102** and a level 2 cache **104** temporarily store data and hence reduce the number of memory access cycles, thereby improving processing speed and throughput. The CPU **101** may be provided having more than one core, and thus, additional level 1 and level 2 caches **102** and **104**. The flash ROM **106** may store executable code that is loaded during an initial phase of a boot process when the multimedia console **100** is powered ON.

[0040] A graphics processing unit (GPU) **108** and a video encoder/video codec (coder/decoder) **114** form a video processing pipeline for high speed and high resolution graphics processing. Data is carried from the GPU **108** to the video encoder/video codec **114** via a bus. The video processing pipeline outputs data to an A/V (audio/video) port **140** for transmission to a television or other display. A memory controller **110** is connected to the GPU **108** to facilitate processor access to various types of memory **112**, such as, but not limited to, a RAM.

[0041] The multimedia console **100** includes an I/O controller **120**, a system management controller **122**, an audio processing unit **123**, a network interface controller **124**, a first USB host controller **126**, a second USB host controller **128** and a front panel I/O subassembly **130** that are preferably implemented on a module **118**. The USB controllers **126** and **128** serve as hosts for peripheral controllers **142(1)**-**142(2)**, a wireless adapter **148**, and an external memory device **146** (e.g., flash memory, external CD/DVD ROM drive, removable media, etc.). The network interface **124** and/or wireless adapter **148** provide access to a network (e.g., the Internet, home network, etc.) and may be any of a wide variety of various wired or wireless adapter components including an Ethernet card, a modem, a Bluetooth module, a cable modem, and the like.

[0042] System memory **143** is provided to store application data that is loaded during the boot process. A media drive **144** is provided and may comprise a DVD/CD drive, hard drive, or other removable media drive, etc. The media drive **144** may be internal or external to the multimedia console **100**. Application data may be accessed via the media drive **144** for execution, playback, etc. by the multimedia console **100**. The media drive **144** is connected to the I/O controller **120** via a bus, such as a Serial ATA bus or other high speed connection (e.g., IEEE 1394).

[0043] The system management controller **122** provides a variety of service functions related to assuring availability of the multimedia console **100**. The audio processing unit **123** and an audio codec **132** form a corresponding audio processing pipeline with high fidelity and stereo processing. Audio data is carried between the audio processing unit **123** and the audio codec **132** via a communication link. The audio processing pipeline outputs data to the A/V port **140** for reproduction by an external audio player or device having audio capabilities.

[0044] The front panel I/O subassembly **130** supports the functionality of the power button **150** and the eject button **152**, as well as any LEDs (light emitting diodes) or other indicators exposed on the outer surface of the multimedia console **100**. A system power supply module **136** provides power to the components of the multimedia console **100**. A fan **138** cools the circuitry within the multimedia console **100**.

[0045] The CPU **101**, GPU **108**, memory controller **110**, and various other components within the multimedia console **100** are interconnected via one or more buses, including serial and parallel buses, a memory bus, a peripheral bus, and a processor or local bus using any of a variety of bus architectures. By way of example, such architectures can include a Peripheral Component Interconnects (PCI) bus, PCI-Express bus, etc.

[0046] When the multimedia console **100** is powered ON, application data may be loaded from the system memory **143** into memory **112** and/or caches **102**, **104** and executed on the CPU **101**. The application may present a graphical user interface that provides a consistent user experience when navigating to different media types available on the multimedia console **100**. In operation, applications and/or other media contained within the media drive **144** may be launched or played from the media drive **144** to provide additional functionalities to the multimedia console **100**.

[0047] The multimedia console **100** may be operated as a standalone system by simply connecting the system to a television or other display. In this standalone mode, the multimedia console **100** allows one or more users to interact with the system, watch movies, or listen to music. However, with the integration of broadband connectivity made available through the network interface **124** or the wireless adapter **148**, the multimedia console **100** may further be operated as a participant in a larger network community.

[0048] When the multimedia console **100** is powered ON, a set amount of hardware resources are reserved for system use by the multimedia console operating system. These resources may include a reservation of memory (e.g., 16 MB), CPU and GPU cycles (e.g., 5%), networking bandwidth (e.g., 8 kbs), etc. Because these resources are reserved at system boot time, the reserved resources do not exist from the application's view.

[0049] In particular, the memory reservation preferably is large enough to contain the launch kernel, concurrent system applications and drivers. The CPU reservation is preferably constant such that if the reserved CPU usage is not used by the system applications, an idle thread will consume any unused cycles.

[0050] With regard to the GPU reservation, lightweight messages generated by the system applications (e.g., popups) are displayed by using a GPU interrupt to schedule code to render popup into an overlay. The amount of memory required for an overlay depends on the overlay area size and the overlay preferably scales with screen resolution. Where a full user interface is used by the concurrent system application, it is preferable to use a resolution independent of the application resolution. A scaler may be used to set this resolution such that the need to change frequency and cause a TV resynch is eliminated.

[0051] After the multimedia console **100** boots and system resources are reserved, concurrent system applications execute to provide system functionalities. The system functionalities are encapsulated in a set of system applications that execute within the reserved system resources described above. The operating system kernel identifies threads that are system application threads versus gaming application threads. The system applications are preferably scheduled to run on the CPU **101** at predetermined times and intervals in order to provide a consistent system resource view to the application. The scheduling is to minimize cache disruption for the gaming application running on the console.

[0052] When a concurrent system application requires audio, audio processing is scheduled asynchronously to the gaming application due to time sensitivity. A multimedia console application manager (described below) controls the gaming application audio level (e.g., mute, attenuate) when system applications are active.

[0053] Input devices (e.g., controllers **142**(**1**) and **142**(**2**)) are shared by gaming applications and system applications. The input devices are not reserved resources, but are to be switched between system applications and the gaming application such that each will have a focus of the device. The application manager preferably controls the switching of input stream, without knowledge of the gaming application's knowledge and a driver maintains state information regarding focus switches. The cameras **26**, **28** and capture device **20** may define additional input devices for the console **100**.

[0054] FIG. **3**B illustrates another example embodiment of a computing environment **220** that may be the computing environment **12** shown in FIGS. **1**A-**2** used to interpret one or more gestures in a target recognition, analysis, and tracking system. The computing system environment **220** is only one example of a suitable computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the presently disclosed subject matter. Neither should the computing environment **220** be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the exemplary operating environment **220**. In some embodiments, the various depicted computing elements may include circuitry configured to instantiate specific aspects of the present disclosure. For example, the term circuitry used in the disclosure can include specialized hardware components configured to perform function(s) by firmware or switches. In other example embodiments, the term circuitry can include a general purpose processing unit, memory, etc., configured by software instructions that embody logic operable to perform function (s). In example embodiments where circuitry includes a combination of hardware and software, an implementer may write source code embodying logic and the source code can be compiled into machine readable code that can be processed by the general purpose processing unit. Since one skilled in the art can appreciate that the state of the art has evolved to a point where there is little difference between hardware, software, or a combination of hardware/software, the selection of hardware versus software to effectuate specific functions is a design choice left to an implementer. More specifically, one of skill in the art can appreciate that a software process can be transformed into an equivalent hardware structure, and a hardware structure can itself be transformed into an equivalent software process. Thus, the selection of a hardware implementation versus a software implementation is one of design choice and left to the implementer.

[0055] In FIG. 3B, the computing environment **220** comprises a computer **241**, which typically includes a variety of computer readable media. Computer readable media can be any available media that can be accessed by computer **241** and includes both volatile and nonvolatile media, removable and non-removable media. The system memory **222** includes computer storage media in the form of volatile and/or nonvolatile memory such as ROM **223** and RAM **260**. A basic input/output system **224** (BIOS), containing the basic routines that help to transfer information between elements within computer **241**, such as during start-up, is typically stored in ROM **223**. RAM **260** typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by processing unit **259**. By way of example, and not limitation, FIG. 3B illustrates operating system **225**, application programs **226**, other program modules **227**, and program data **228**.

[0056] The computer **241** may also include other removable/non-removable, volatile/nonvolatile computer storage media. By way of example only, FIG. 3B illustrates a hard disk drive **238** that reads from or writes to non-removable, nonvolatile magnetic media, a magnetic disk drive **239** that reads from or writes to a removable, nonvolatile magnetic disk **254**, and an optical disk drive **240** that reads from or writes to a removable, nonvolatile optical disk **253** such as a CD ROM or other optical media. Other removable/non-removable, volatile/nonvolatile computer storage media that can be used in the exemplary operating environment include, but are not limited to, magnetic tape cassettes, flash memory cards, digital versatile disks, digital video tape, solid state RAM, solid state ROM, and the like. The hard disk drive **238** is typically connected to the system bus **221** through a non-removable memory interface such as interface **234**, and magnetic disk drive **239** and optical disk drive **240** are typically connected to the system bus **221** by a removable memory interface, such as interface **235**.

[0057] The drives and their associated computer storage media discussed above and illustrated in FIG. 3B, provide storage of computer readable instructions, data structures, program modules and other data for the computer **241**. In FIG. 3B, for example, hard disk drive **238** is illustrated as storing operating system **258**, application programs **257**, other program modules **256**, and program data **255**. Note that these components can either be the same as or different from operating system **225**, application programs **226**, other program modules **227**, and program data **228**. Operating system **258**, application programs **257**, other program modules **256**, and program data **255** are given different numbers here to illustrate that, at a minimum, they are different copies. A user may enter commands and information into the computer **241** through input devices such as a keyboard **251** and a pointing device **252**, commonly referred to as a mouse, trackball or touch pad. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit **259** through a user input interface **236** that is coupled to the system bus, but may be connected by other interface and bus structures, such as a parallel port, game port or a universal serial bus (USB). The cameras **26**, **28** and capture device **20** may define additional input devices for the console **100**. A monitor **242** or other type of display device is also connected to the system bus **221** via an interface, such as a video interface **232**. In addition to the monitor, computers may also include other peripheral output devices such as speakers **244** and printer **243**, which may be connected through an output peripheral interface **233**.

[0058] The computer **241** may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer **246**. The remote computer **246** may be a personal computer, a server, a router, a network PC, a peer device or other common network node, and typically includes many or all of the elements described above relative to the computer **241**, although only a memory storage device **247** has been illustrated in FIG. 3B. The logical connections depicted in FIG. 3B include a local area network (LAN) **245** and a wide area network (WAN) **249**, but may also include other networks. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the Internet.

[0059] When used in a LAN networking environment, the computer **241** is connected to the LAN **245** through a network interface or adapter **237**. When used in a WAN networking environment, the computer **241** typically includes a modem **250** or other means for establishing communications over the WAN **249**, such as the Internet. The modem **250**, which may be internal or external, may be connected to the system bus **221** via the user input interface **236**, or other appropriate mechanism. In a networked environment, program modules depicted relative to the computer **241**, or portions thereof, may be stored in the remote memory storage device. By way of example, and not limitation, FIG. 3B illustrates remote application programs **248** as residing on memory device **247**. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

[0060] The computing environment **12** in conjunction with the capture device **20** may generate a computer model of a user's body position each frame. One example of such a pipeline which generates a skeletal model of one or more users in the field of view of capture device **20** is disclosed for example in U.S. patent application Ser. No. 12/876,418, entitled "System For Fast, Probabilistic Skeletal Tracking," filed Sep. 7, 2010, which application is incorporated by reference herein in its entirety.

[0061] The skeletal model may then be provided to the computing environment **12** such that the computing environment may track the skeletal model and render an avatar associated with the skeletal model. The computing environment may further determine which controls to perform in an application executing on the computer environment based on, for example, gestures of the user that have been recognized from the skeletal model. For example, as shown, in FIG. **2**, the computing environment **12** may include a gesture recognition engine **190**. The gesture recognition engine **190** is explained hereinafter, but may in general include a collection of gesture filters, each comprising information concerning a gesture that may be performed by the skeletal model (as the user moves).

[0062] The data captured by the cameras **26**, **28** and device **20** in the form of the skeletal model and movements associated with it may be compared to the gesture filters in the gesture recognition engine **190** to identify when a user (as represented by the skeletal model) has performed one or more gestures. Those gestures may be associated with various controls of an application. Thus, the computing environment **12** may use the gesture recognition engine **190** to interpret movements of the skeletal model and to control an application based on the movements. For example, in the context of the present disclosure, the gesture recognition engine may recognize when a user is performing a peer gesture to peer into the virtual distance of the scene displayed on display **14**.

[0063] FIG. **4** depicts an example skeletal mapping of a user that may be generated from the capture device **20**. In this embodiment, a variety of joints and bones are identified: each hand **302**, each forearm **304**, each elbow **306**, each bicep **308**, each shoulder **310**, each hip **312**, each thigh 314, each knee **316**, each foreleg **318**, each foot **320**, the head **322**, the mid spine **324**, the top 326 and the bottom **328** of the spine, and the waist **330**. Where more points are tracked, additional features may be identified, such as the bones and joints of the fingers or toes, or individual features of the face, such as the nose and eyes.

[0064] The peer gesture engine **192** will now be explained in greater detail with reference to the flowchart of FIG. **5** and the illustration of FIG. **6**. As noted above, the peer gesture may be performed by a user moving his hand into a predefined position with respect to his head as shown in FIGS. **1**D and **1**E. In particular, the user may cups his eyes with his hand. When performing the peer gesture, the hand may generally be in an x-z plane with respect to the capture device **20** with the index finger near or in contact with the forehead (as if shielding the sun from his or her eyes). In contexts other than a gaming situation or use of a NUI system, this gesture often connotes that the performer is peering into the distance to get a better view of objects that are far off Despite this real world connotation and intuitive adaptation as a predefined gesture in a NUI application, it is understood that a wide variety of other gestures may alternatively be used as a peer gesture according to the present disclosure. The peer gesture may be performed with either hand.

[0065] In step **400**, the gesture recognition engine **190** detects whether the peer gesture was performed as explained below. In embodiments, the gesture recognition engine may require that the peer gesture is performed for some predetermined period of time before executing the peer steps. This prevents other motions where a user touches his face or forehead from incorrectly being interpreted as a peer gesture.

[0066] If the peer gesture is detected, the peer engine determines the user's head orientation relative to the capture device **20** and display **14** in step **404**. This information is available from the skeletal model generated by the body recognition pipeline. The peer gesture interprets this as the direction in which the user wishes to look. It therefore creates a peer vector in that direction. The system may ignore the specific direction where a user is looking in alternative embodiments. In these embodiments, upon detecting the peer gesture, the system ignores where the user's head is pointing. Upon a peer gesture, the in-game camera view moves forward from its current viewing direction, which may be directly behind the player's avatar. In a further embodiment, if the player wishes to view in another direction they can side step in the real world to adjust their aim around the ball, and hence the camera orientation, and then trigger the peer gesture. This is analogous to a user peering into the display **14** like they would through a window, rather than along their own eye line in the real world.

[0067] In step **408**, the display is altered to in effect travel along the peer vector into the virtual scene. As one example, if a user is looking down the fairway of a golf hole toward the green, the view may change to in effect travel down the fairway to the green, where the user can view aspects of the green in greater detail. The user may opt to peer at other aspects of a golf hole or other scenes in further embodiments. In further embodiments, the peer view will depend on where the player avatar is positioned on the virtual geometric ground model. For example, in a golf game, the route which is taken is based on where the player avatar is on the course. The virtual camera will go forward initially and try to match the best (nearest) predefined path. Thus, for example, if the player is on the fairway, the camera will follow the fairway path to the green. If the player is in the rough, the camera will follow the shortcut path to the green, and so on.

[0068] In embodiments, there may be predefined sight lines. For example, referring to the illustration of a golf hole **450** in FIG. **6**, there exists a pair of predefined sight lines **452** and **454**. If no such predefined sight lines exist in step **410**, the peer engine **192** may advance a predefined distance into the virtual scene and then stop. Alternatively, the peer engine may advance until the user ceases the gesture (drops his hand away). As noted above, there may always be a predefined path, if only a straight line between the current avatar position and the destination (for example, the flag in a golf game). In such instances, step **410** may be omitted.

[0069] On the other hand, if there are predefined sight lines as shown in FIG. **6**, the display may change by gradually bending away from the peer vector as the view advances into the scene toward the nearest predefined sight line. Once at the sight line, the peer engine may change the display to advance along the sight line to a predefined location at the end of the sight line in step **422**.

[0070] Thus, for example, where a user's avatar **19** is at the tee box of a golf hole, the user may perform the peer gesture while looking at the display in the direction of line **458**. In this case, the view may advance initially along line **458**, but then bend toward sight line **452**. Once at sight line **452**, the view advances until the user is shown the green for that hole. Alternatively, the user may perform the peer gesture while looking at the display in the direction of line **460**. In this case, the view may advance initially along line **460**, but then bend toward sight line **454**. Once at sight line **454**, the view advances until the user is shown the portion of the hole which dog-legs (turns) left.

[0071] Once at the peer destination (either at step **414** or **422**), the display view may stay on that location for a predefined period of time (step **426**), or until the user ceases the peer gesture, at which point the display view may be returned to the starting point from where the peer gesture was initially performed.

[0072] The gesture recognition engine **190** for recognizing the peer gesture and other predefined gestures will now be explained with reference to FIGS. **7** and **8**. Those of skill in the art will understand a variety of methods of analyzing user body movements and position to determine whether the movements/position conform to a predefined gesture. Such methods are disclosed for example in the above incorporated application Ser. No. 12/475,308, as well as U.S. Patent Application Publication No. 2009/0074248, entitled "Gesture-Controlled Interfaces For Self-Service Machines And Other Applications," which publication is incorporated by reference herein in its entirety. However, in general, user positions and movements are detected by the capture device **20**. From this data, joint position vectors may be determined. The joint position vectors may then passed to the gesture recognition engine **190**, together with other pose information. The operation of gesture recognition engine **190** is explained in greater detail with reference to the block diagram of FIG. **7** and the flowchart of FIG. **8**.

[0073] The gesture recognition engine **190** receives pose information **500** in step **550**. The pose information may include a great many parameters in addition to joint position vectors. Such additional parameters may include the x, y and z minimum and maximum image plane positions detected by the capture device **20**. The parameters may also include a measurement on a per-joint basis of the velocity and acceleration for discrete time intervals. Thus, in embodiments, the gesture recognition engine **190** can receive a full picture of the position and kinetic activity of all points in the user's body.

[0074] The gesture recognition engine **190** analyzes the received pose information **500** in step **554** to see if the pose information matches any predefined rule **542** stored within a gestures library **540**. A stored rule **542** describes when particular positions and/or kinetic motions indicated by the pose information **500** are to be interpreted as a predefined gesture. In embodiments, each gesture may have a different, unique rule or set of rules **542**. Each rule may have a number of parameters (joint position vectors, maximum/minimum position, change in position, etc.) for one or more of the body parts shown in FIG. **4**. A stored rule may define, for each parameter and for each body part **302** through **330** shown in FIG. **4**, a single value, a range of values, a maximum value, a minimum value or an indication that a parameter for that body part is not relevant to the determination of the gesture covered by the rule. Rules may be created by a game author, by a host of the gaming platform or by users themselves.

[0075] The gesture recognition engine **190** may output both an identified gesture and a confidence level which corresponds to the likelihood that the user's position/movement corresponds to that gesture. In particular, in addition to defining the parameters required for a gesture, a rule may further include a threshold confidence level required before pose information **500** is to be interpreted as a gesture. Some gestures may have more impact as system commands or gaming instructions, and as such, require a higher confidence level before a pose is interpreted as that gesture. The comparison of the pose information against the stored parameters for a rule results in a cumulative confidence level as to whether the pose information indicates a gesture.

[0076] Once a confidence level has been determined as to whether a given pose or motion satisfies a given gesture rule, the gesture recognition engine **190** then determines in step **556** whether the confidence level is above a predetermined threshold for the rule under consideration. The threshold confidence level may be stored in association with the rule under consideration. If the confidence level is below the threshold, no gesture is detected (step **560**) and no action is taken. On the other hand, if the confidence level is above the threshold, the user's motion is determined to satisfy the gesture rule under consideration, and the gesture recognition engine **190** returns the identified gesture.

[0077] Given the above disclosure, it will be appreciated that a great many gestures may be identified using joint position vectors in addition to the peer gesture. As one of many examples, the user may lift and drop each leg **312**-**320** to mimic walking without moving.

[0078] The foregoing detailed description of the inventive system has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the inventive system to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. The described embodiments were chosen in order to best explain the principles of the inventive system and its practical application to thereby enable others skilled in the art to best utilize the inventive system in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the inventive system be defined by the claims appended hereto.

1. A method for implementing a peer gesture via a natural user interface, comprising:

(a) determining if a user has performed a predefined gesture relating to peering into a virtual distance with respect to a scene displayed on a display; and

(b) changing the display to create the impression of peering into the virtual distance of the scene displayed on the display upon determining that the user has performed the predefined peering gesture in said step (a).

2. The method of claim **1**, wherein said step of determining if a user has performed a predefined gesture relating to peering into a virtual distance comprises the step of determining whether the user has positioned one or two hands in a predetermined position with respect to the user's face.

3. The method of claim **2**, wherein said step of determining if a user has performed a predefined gesture relating to peering into a virtual distance comprises the step of determining whether the user has cupped the user's eyes with one or both hands.

4. The method of claim **1**, wherein said step of determining if a user has performed a predefined gesture relating to peering into a virtual distance comprises the step of determining whether the user has performed the predefined gesture for a predetermined period of time.

5. The method of claim **1**, wherein said step of changing the display to create the impression of peering into the virtual distance comprises the step of enlarging virtual objects on the display to create the impression of viewing the enlarged virtual objects from a closer perspective.

6. A system for implementing a peer gesture via a natural user interface, comprising:

(a) a display for displaying a virtual three-dimensional scene; and

(b) a computing device for executing an application, the application generating the virtual three-dimensional scene on the display, and the application including a peer gesture software engine for receiving an indication of a predefined peer gesture, and for causing a view of the three-dimensional scene to change by moving along a path from a first perspective displaying a first point to a second perspective displaying a second point which is virtually distal from the first point.

7. A system as recited in claim **6**, wherein the path along which the view is of the scene is changed is at least substantially a predefined path to the second point.

8. A system as recited in claim **6**, wherein the path along which the view is of the scene is changed is a path which initially moves to a nearest predefined path and then along the predefined path, to the second point.

9. A system as recited in claim **8**, wherein the application includes two or more predefined paths for a virtual three-dimensional scene displayed on the display.

10. A system as recited in claim **9**, wherein each of the two or more predefined paths includes a different second point.

11. A system as recited in claim **6**, wherein the path along which the view is of the scene is changed is determined by a detected direction of the user's head.

12. A system as recited in claim **6**, wherein the path along which the view is of the scene is changed is determined by a peer vector representing a vector straight out from a face of a user.

13. A system as recited in claim **6**, the peer gesture software engine further receiving an indication that a user has stopped performing the predefined peer gesture, and returning the view of the virtual three-dimensional scene to the view from the first point a predetermined period of time after the peer gesture software engine receives an indication that the user has stopped performing the predefined peer gesture.

14. A system as recited in claim **6**, further comprising a gesture recognition software engine for recognizing performance of the predefined peer gesture.

15. A processor-readable storage media having processor-readable code embodied on said processor-readable storage media, said processor readable code for programming one or more processors of a computing device to perform a method comprising:

(a) providing a three-dimensional view of a virtual golf hole in a golf gaming application;

(b) determining if a user has performed a predefined gesture relating to peering into a virtual distance with respect to the virtual golf hole displayed on a display; and

(c) changing the view of the virtual golf hole by moving along a path from a first point in the foreground of a view to a second point at or nearer to a virtual green of the virtual golf hole to show the second point at or nearer to the virtual green in greater detail.

16. A processor-readable storage media as recited in claim **15**, wherein said step of determining if a user has performed a predefined gesture relating to peering into a virtual distance comprises the step of determining whether the user has cupped the user's eyes with one or both hands.

17. A processor-readable storage media as recited in claim **15**, wherein said step of determining if a user has performed a predefined gesture relating to peering into a virtual distance comprises the step of determining whether the user has cupped the user's eyes with one or both hands.

18. A processor-readable storage media as recited in claim **15**, wherein the path along which the view is of the golf hole is changed is a path which initially moves to a nearest predefined path and then along the predefined path, at or nearer to the virtual green.

19. A processor-readable storage media as recited in claim **15**, wherein the view of the second point at or nearer to a virtual green is maintained for a predetermined period of time and then returning the view to the first point.

20. A processor-readable storage media as recited in claim **15**, wherein the view of the second point at or nearer to a virtual green is maintained until determining that the user has stopped performing the predefined gesture and then returning the view to the first point.

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