

SOUND PROMPTING METHOD AND APPARATUS IN VIRTUAL WORLD, AND DEVICE AND STORAGE MEDIUM

RELATED APPLICATION

[0001] The present application claims priority to Chinese Patent Application No. 202110898406.6, entitled “METHOD AND APPARATUS FOR PROMPTING FOR SOUND IN VIRTUAL WORLD, DEVICE AND STORAGE MEDIUM” filed with the China National Intellectual Property Administration on August 05, 2021, which is incorporated herein by reference in its entirety.

FIELD OF THE TECHNOLOGY

[0002] Embodiments of the present application relate to the field of human-computer interaction, in particular to a method and an apparatus for prompting a sound in a virtual world, a device and a storage medium.

BACKGROUND OF THE DISCLOSURE

[0003] A user can operate the game characters in a game program for athletics competition. The game program is provided with a virtual world, and the game characters are virtual characters in the virtual world.

[0004] A game screen and a mini-map control are displayed on a terminal. The game screen is a screen from which the virtual world is observed from a perspective of the current game character, and the mini-map control is a control for displaying a top view map of the virtual world. When there are other game characters around the current game character, if the other game characters produce sounds while acting in the virtual world, a sound icon is displayed on the mini-map control, thereby prompting for a gunshot, a footstep, a muffler sound, etc. in mini-map space according to the sound icon. For example, a sound icon of a pair of footprints is displayed on a point A on the mini-map control, and indicates that there are other game characters walking at a position corresponding to the point A on the mini-map control in the virtual world.

[0005] Since the display area of the mini-map control is limited, the above-mentioned sound icon cannot provide a specific position of the sound source in the virtual world, effective information that may be provided is limited, and it is difficult for the user to determine the position of the sound source conveniently and quickly from the prompt of the sound icon, which is not advantageous for the game character to have a deeper confrontation in the virtual world.

SUMMARY

[0006] The present application provides a method and an apparatus for prompting for a sound in a virtual world, a device, and a storage medium, by which a horizontal azimuth and a vertical azimuth of a sound source in the virtual world can both be indicated via a sound indicator. The technical solutions are as follows.

[0007] According to an aspect of the present application, a method for prompting for a sound in a virtual world is provided, the method including:

[0008] displaying a perspective screen of a first virtual character, compass information being displayed on the perspective screen, the compass information including an azimuth scale sequence, , and an azimuth scale in the azimuth scale sequence indicating a horizontal azimuth that the first virtual character faces in the virtual world;

[0009] controlling the first virtual character to act in the virtual world; and

[0010] displaying a first sound indicator based on a first azimuth scale in the azimuth scale sequence if there is a first sound source in surroundings of the first virtual character during the action of the first virtual character in the virtual world, the first sound indicator indicating a horizontal azimuth and a vertical azimuth corresponding to the first sound source.

[0011] According to another aspect of the present application, an apparatus for prompting for a sound in a virtual world is provided, the apparatus including:

[0012] a display module, configured to display a perspective screen of a first virtual character, compass information being displayed on the perspective screen, the compass information including an azimuth scale sequence, and an azimuth scale in the azimuth scale sequence indicating a horizontal azimuth that the first virtual character faces in the virtual world; and

[0013] a control module, configured to control the first virtual character to act in the virtual world,

[0014] the display module being further configured to display a first sound indicator based on a first azimuth scale in the azimuth scale sequence if there is a first sound source in surroundings of the first virtual character during the action of the first virtual character in the virtual world, the first sound indicator indicating a horizontal azimuth and a vertical azimuth corresponding to the first sound source.

[0015] According to another aspect of the present application, a computer device is provided, the computer device including: a processor and a memory having stored therein at least

one program loaded and executed by the processor to implement the method for prompting for a sound in a virtual world in the above aspect.

[0016] According to another aspect of the present application, a computer-readable storage medium is provided, the computer-readable storage medium having stored thereon at least one piece of program loaded and executed by a processor to implement the method for prompting for a sound in a virtual world in the above aspect.

[0017] According to another aspect of the present application, a computer program product is provided, the computer program product, when executed, causing a processor to implement the method for prompting for a sound in a virtual world in the above aspect.

[0018] The technical solutions according to the embodiments of the present application have at least the following beneficial effects.

[0019] When there is a first sound source in the surroundings of the first virtual character, a first sound indicator may be displayed based on the first azimuth scale in the azimuth scale sequence, and a horizontal azimuth and a vertical azimuth corresponding to the first sound source may be simultaneously indicated by the first sound indicator, as compass information is displayed on a perspective screen where the first virtual character is located and the compass information includes an azimuth scale sequence, so that a user can accurately determine a specific spatial position of the first sound source merely by means of visual presentation, and in an auditory-limited scene without the need for loud-speaking or using headphones, enough effective spatial information for the sound source can also be obtained to facilitate the first virtual character to have a deeper confrontation in the virtual world.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] To describe the technical solutions of the embodiments of the present application more clearly, the following briefly introduces the accompanying drawings required for describing the embodiments. Apparently, the accompanying drawings in the following description show only some embodiments of the present application, and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

[0021] FIG. 1 is a block diagram showing a computer system according to an exemplary embodiment of the present application;

[0022] FIG. 2 is a flowchart of a method for prompting for a sound in a virtual world according to an exemplary embodiment of the present application;

[0023] FIG. 3 is an interface diagram showing a virtual environment picture according to an exemplary embodiment of the present application;

[0024] FIG. 4 is a schematic diagram showing three prompts for a sound in a vertical direction according to an exemplary embodiment of the present application;

[0025] FIG. 5 is a flowchart of a method for prompting for sounds in a virtual world according to an exemplary embodiment of the present application;

[0026] FIG. 6 is a schematic diagram showing an interface for prompting for a sound from above according to an exemplary embodiment of the present application;

[0027] FIG. 7 is a schematic diagram showing an interface for prompting for two sound types according to an exemplary embodiment of the present application;

[0028] FIG. 8 is a schematic diagram showing an interface for prompting for sounds with icon patterns according to an exemplary embodiment of the present application;

[0029] FIG. 9 is a schematic diagram showing prompting for sounds at different distances according to an exemplary embodiment of the present application;

[0030] FIG. 10 is a schematic diagram showing an interface of a second sound indicator according to an exemplary embodiment of the present application;

[0031] FIG. 11 is a schematic diagram showing a vertical direction sound confirmation according to an exemplary embodiment of the present application;

[0032] FIG. 12 is a configuration diagram showing influence of a helmet or a headphone on prompting for a sound according to an exemplary embodiment of the present application;

[0033] FIG. 13 is a configuration diagram showing influence of a muffler on prompting for a sound according to an exemplary embodiment of the present application;

[0034] FIG. 14 is a configuration diagram showing influence of a treaded-on material on prompt for a sound according to an exemplary embodiment of the present application;

[0035] FIG. 15 is a configuration diagram showing influence coefficients of different sound types according to an exemplary embodiment of the present application;

[0036] FIG. 16 is a configuration diagram showing parameters of different gun types according to an exemplary embodiment of the present application;

[0037] FIG. 17 is a configuration diagram showing general configuration parameters for prompting for a sound according to an exemplary embodiment of the present application;

[0038] FIG. 18 is a flowchart showing a method for prompting for a sound in a virtual world according to an exemplary embodiment of the present application;

[0039] FIG. 19 is a structural block diagram of a terminal according to an exemplary embodiment of the present application;

[0040] FIG. 20 is a schematic structural diagram of a server according to an exemplary embodiment of the present application.

DESCRIPTION OF EMBODIMENTS

[0041] To make the objectives, technical solutions, and advantages of the present application clearer, the following further describes implementations of the present application in detail with reference to the accompanying drawings.

[0042] Firstly, the terms involved in the embodiments of the present application are introduced:

[0043] **Shooting game:** a game in which remote attacks are launched using remote attack weapons such as hot or cold weapons, for example, first-person shooting (FPS), third-person shooting (TPS), etc. Optionally, the first-person shooting game is a shooting game played in a primary perspective of a player, and compared with other games, the player no longer manipulates a virtual characters displayed in the screen to play the game, but is personally on the scene in the primary perspective to experience the visual impact from the game. The difference between the third-person shooting game and the first-person shooting game lies in that in the first-person shooting game, only different views of a leading role is displayed on a screen, while a game character controlled by a player in the third-person shooting game is visible on the game screen to highlight the sense of action.

[0044] **Virtual world:** a world that an application displays (or provides) when running on a terminal. The virtual world may be a three-dimensional virtual world or a two-dimensional virtual world. The three-dimensional virtual world may be a simulation of a real world, a semi-simulated semi-fictitious environment, or a purely fictitious environment. The virtual world is a three-dimensional virtual world in the following embodiments, for example, which is not limited thereto. Optionally, the virtual world is also used for a virtual scene fight between at least two virtual characters. Optionally, the virtual scene is also used for fighting between at least two virtual characters using virtual guns.

[0045] **Virtual character:** a movable object in a virtual world. The movable object may be a simulated character or an animated character in a virtual world. Optionally, in a case that the

virtual world is a three-dimensional virtual environment, the virtual object is a three-dimensional stereo model created according to an animated skeleton technology. Each virtual object has its own shape and volume in the three-dimensional virtual scene, occupying a portion of the space in the three-dimensional virtual scene. According to the embodiments of the present application, a virtual character may be an individual in a virtual world that may independently produce a different sound, which includes a first virtual character and a second virtual character respectively representing independent individuals producing different sounds. An individual who is producing a sound may act as a sound source.

[0046] Sound indicator: a visual control for indicating sound information in a virtual world and having one or more visual presentations, and each visual presentation represents a kind of sound information including: at least one of a horizontal azimuth, a vertical azimuth, a sound type, a sound volume, a sound distance, and a frequency of action of a sound source.

[0047] Visual presentation of a sound indicator: a display effect displayed on the sound indicator that may be visually captured by a user. Each visual presentation includes: one or a combination of a shape, a pattern, a color, a texture, text, an animation effect, a display-starting time, a display duration, and a fading-out time. Different kinds of visual presentations are different. Optionally, visual presentations of different dimensions are superimposed together on the same sound indicator to present different information.

[0048] FIG. 1 illustrates a block diagram of a computer system according to an exemplary embodiment of the present application. The computer system 100 includes: a first terminal 120, a server cluster 140 and a second terminal 160.

[0049] The first terminal 120 is installed with and runs a game program supporting a virtual environment. The game program may be a first-person shooting game or a third-person shooting game. The first terminal 120 may be a terminal used by a first user, and the first user uses the first terminal 120 to operate a first virtual character located in a virtual world to act, where the action includes but is not limited to: at least one of sprint, climb, squat walk, quiet walk, quiet climb, quiet squat walk, single shot, continuous shots, Non-Player Character (NPC) cry, grass smear, cry due to wound, dying cry, explosion, and walk. Exemplarily, the first virtual character is a first virtual character.

[0050] The first terminal 120 is connected to the server cluster 140 through a wireless network or a wired network.

[0051] The server cluster 140 includes at least one of a server, a plurality of servers, a cloud computing platform, and a virtualization center. The server cluster 140 is used for providing background services for applications that support the virtual environment. Optionally, the server cluster 140 undertakes the primary computing work, and the first terminal 120 and the second terminal 160 undertake the secondary computing work; alternatively, the server cluster 140 undertakes the secondary computing work, and the first terminal 120 and the second terminal 160 undertake the primary computing work; alternatively, the server cluster 140, the first terminal 120 and the second terminal 160 perform cooperative computing therebetween using a distributed computing architecture.

[0052] The second terminal 160 is installed with and runs a game program supporting a virtual environment. The game program may be a first-person shooting game or a third-person shooting game. The second terminal 160 may be a terminal used by a second user, and the second user uses the second terminal 160 to operate a second virtual character located in a virtual world to act, where the action includes but is not limited to: at least one of sprint, climb, squat walk, quiet walk, quiet climb, quiet squat walk, single shot, continuous shots, NPC cry, grass smear, cry due to wound, dying cry, explosion, and walk. Exemplarily, the second virtual character is a second virtual character. The first virtual character and the second virtual character may belong to the same team, the same organization, have a friend relationship or have temporary communication authority.

[0053] Optionally, the applications installed on the first terminal 120 and the second terminal 160 are the same, or are the same type of applications on different platforms. The first terminal 120 may generally refer to one of a plurality of terminals, and the second terminal 160 may generally refer to one of a plurality of terminals, where the first terminal 120 and the second terminal 160 are described in the embodiment for example.

[0054] The first terminal 120 and the second terminal 160 may be desktop devices or mobile devices. In a case that the first terminal 120 and the second terminal 160 are mobile devices, the types of the mobile devices of the first terminal 120 and the second terminal 160 are the same or different, and the mobile devices include: smartphones, tablet computers, and all portable electronic devices, without being limited thereto.

[0055] FIG. 2 is a flowchart of a method for prompting for a sound in a virtual world according to an exemplary embodiment of the present application. The method may be performed by the first terminal 120 or the second terminal 160 shown in FIG. 1, and the first terminal 120 or the second terminal 160 may be collectively referred to as a terminal. The method includes steps 202 to 206.

[0056] Step 202: Display a perspective screen of a first virtual character, where compass information is displayed on the perspective screen and includes an azimuth scale sequence.

[0057] The compass information (or compass control) is indicates, with the foothold of the first virtual character in the virtual world as a reference point, various horizontal azimuths the first virtual character faces in the virtual world. Exemplarily, the horizontal azimuth is represented by a longitude in the virtual world, e.g., 20 degrees east longitude, 160 degrees west longitude, etc.

[0058] Exemplarily, as shown in FIG. 3, a first virtual character 10, a movement wheel 12, a skill button 14, and compass information 16 are displayed on the perspective screen. The first virtual character 10 may be any movable object in the virtual world, such as a soldier located in the virtual world. The moving wheel 12 is used for controlling the movement of the first virtual character 10 in the virtual world, and the skill button 14 is used for controlling the first virtual character 10 to release skills or use articles in the virtual world. The compass information 16 includes an azimuth scale sequence displayed which may be a sequence of a plurality of azimuth scales, and the azimuth scale in the azimuth scale sequence indicates the horizontal azimuth the first virtual character faces in the virtual world. In FIG. 3, the azimuth scale sequence includes 7 azimuth scales: 165 degrees, south, 195 degrees, 215 degrees, southwest, 240 degrees, and 255 degrees. The azimuth scale of 215 degrees indicates a horizontal azimuth directly in front of the first virtual character 10.

[0059] Step 204: Control the first virtual character to act in the virtual world.

[0060] According to an embodiment of the present application, a user may control action of the first virtual character in the virtual world. The action herein may include various forms of activities such as moving, releasing skills, using articles, etc. The different activities may be controlled differently, for example the user may control the first virtual character 10 to move by the movement wheel 12, or the user may control the first virtual character to release skills or use articles by pressing one or more preset skills buttons 14. The user may also control the first virtual character by a signal generated by a long press, click, double click and/or slide on the touch screen.

[0061] Step 206: Display a first sound indicator based on a first azimuth scale in the azimuth scale sequence if there is a first sound source in surroundings of the first virtual character during the action of the first virtual character in the virtual world, where the first sound indicator indicates a horizontal azimuth and a vertical azimuth of the first sound source.

[0062] Exemplarily, the surroundings of the first virtual character are a virtual environment within a three-dimensional sphere with the first virtual character as a center and a preset distance as

a radius. Alternatively, the surroundings of the first virtual character are a virtual environment within a three-dimensional hemisphere located on the ground with the first virtual character as a center and a preset distance as a radius.

[0063] The first sound source may be a virtual element in the virtual world having sound producing capabilities, such as a second virtual character (friend or enemy or NPC), a virtual vehicle, a virtual flying object, various aggressive weapons, virtual animals, etc. The second virtual character may be a virtual character other than the first virtual character in the virtual world, and the number of second virtual characters is at least one. Since the virtual world is a digitally simulated environment, the sound in the present application may refer to a sound event in the digitized world, and the sound event is represented by a set of parameters. The set of parameters for the sound event includes, but is not limited to: at least one of a three-dimensional coordinate of a sound source in the virtual world, a type of the sound source, a material type in contact with the sound source, a sound type, an original sound volume, and an equipment wearing condition of the sound source.

[0064] If there is a first sound source in the surroundings of the first virtual character, it is indicated that a virtual element (also referred to as an individual in the virtual world) in the surroundings produces a sound (e.g., a first sound), that is, the virtual element (individual) is the first sound source, so that a first sound indicator may be displayed based on the first azimuth scale in the azimuth scale sequence. The first sound indicator indicates a horizontal azimuth and a vertical azimuth of the first sound source. The horizontal azimuth is an azimuth obtained by division in a horizontal direction with the first virtual object as a center, e.g., a longitude in the virtual world. The vertical azimuth is an azimuth obtained by division in a vertical direction with the first virtual object as a center, for example, a pitch angle of a sound source (e.g., a first sound source) relative to the first virtual character. Optionally, the vertical azimuth is represented by a vertical azimuth scale, similar to a latitude; alternatively, the vertical azimuth is represented by an altitude; alternatively, since the virtual character has a limited movement space in the vertical direction, the vertical azimuth may be simplified or abstracted as: an upper azimuth, a middle azimuth, and a lower azimuth.

[0065] According to an embodiment of the present application, the horizontal azimuth of the first sound source may be a first horizontal azimuth, the vertical azimuth of the first sound source may be a first vertical azimuth, the first horizontal azimuth of the first sound source may be indicated by a first azimuth scale, the first vertical azimuth of the first sound source may be represented by a first visual presentation of the first sound indicator, and the first visual presentation

may be at least one of a shape, a pattern, a color, a texture, text, and an animation effect of the first sound indicator.

[0066] Exemplarily, the terminal may display the first sound indicator having the first visual presentation based on the first azimuth scale in the azimuth scale sequence, a center of the first sound indicator is aligned with the first azimuth scale, the first azimuth scale indicates the horizontal azimuth of the first sound source and the first visual presentation indicates the vertical azimuth of the first sound source.

[0067] In summary, according to the method in the embodiment, by merely displaying the first sound indicator based on the first azimuth scale in the azimuth scale sequence in a case there is the first sound source in the surroundings of the first virtual character, the first horizontal azimuth and the first vertical azimuth corresponding to the first sound source can simultaneously be indicated by the first sound indicator, so that a user can accurately determine the spatial position of the first sound source merely by means of visual presentation, without the mini-map to show the position, and acquire sufficient and effective spatial information for the sound source in an auditory-limited scene without the need of loud-speaking or using headphones. Exemplarily, as shown in FIG. 3, a first sound indicator 19 is displayed based on the first azimuth scale “southwest” in the compass information 16, in a case that the first sound source in the surroundings of the first virtual character 10 produces a first sound. The first azimuth scale “southwest” indicates that the horizontal azimuth of the first sound source is a southwest azimuth. The shape of the first sound indicator 19 indicates that the vertical azimuth of the first sound source is a middle azimuth.

[0068] For example, the first visual presentation is a shape, for example. With reference to the implementation (a) in FIG. 4, in a case that the shape of the first sound indicator 19 is an up-pointing triangle, it is indicated that the first sound source is located at an upper azimuth of the first virtual character; in a case that the first sound indicator 19 is fusiform, it is indicated that the first sound source is located at a middle azimuth of the first virtual character; in a case that the shape of the first sound indicator 19 is a down-pointing triangle, it is indicated that the first sound source is located at a lower azimuth of the first virtual character.

[0069] For example, the first visual presentation is an arrow to the left of the first sound indicator 19. With reference to the implementation (b) in FIG. 4, in a case that the arrow to the left of the first sound indicator 19 points upward, it is indicated that the first sound source is located at an upper azimuth of the first virtual character; in a case that the arrow to the left of the first sound indicator 19 is circular, it is indicated that the first sound source is located at a middle azimuth of the first virtual character; in a case that the arrow to the left of the first sound indicator 19 points

downward, it is indicated that the first sound source is located at a lower azimuth of the first virtual character.

[0070] For example, the first visual presentation is a filling color of the first sound indicator 19. With reference to the implementation (c) in FIG. 4, the first sound indicator 19 includes three lattices arranged vertically. In a case that the uppermost lattice of the three lattices has a filling color, it is indicated that the first sound source is located at an upper azimuth of the first virtual character; in a case that the middle lattice of the three lattices has a filling color, it is indicated that the first sound source is located at a middle azimuth of the first virtual character; in a case that the lowest lattice of the three lattices has a filling color, it is indicated that the first sound source is located at a lower azimuth of the first virtual character.

[0071] For example, the first visual presentation is a shape of the first sound indicator 19 and an additional number. With reference to the implementation (d) in FIG. 4, in a case that the shape of the first sound indicator 19 is an up-pointing triangle with the number “+100 m”, it is indicated that the first sound source is located at an upper azimuth of the first virtual character and is 100 meters above the ground; in a case that the first sound indicator 19 is fusiform, it is indicated that the first sound source is located at a middle azimuth of the first virtual character; in a case that the shape of the first sound indicator 19 is a down-pointing triangle with the number “-15 m”, it is indicated that the first sound source is located at a lower azimuth of the first virtual character and is 15 meters below the ground.

[0072] By the method according to the embodiment, various sound information of the first sound source can be prompted for based on the first sound indicator near the compass information in case of no mini-map control on a user interface. In case of presence of the first sound source, the sound can be prompted for in multiples aspects based on a plurality of visual presentations on the first sound indicator, which occupies a very small screen area; in the absence of the first sound source, as few Head Up Display (HUD) controls are displayed on the entire user interface as possible, thereby making the user interface more compact and efficient, which can provide a more immersive program use experience for the user.

[0073] FIG. 5 is a flowchart of a method for prompting for a sound in a virtual world according to an exemplary embodiment of the present application. The method may be performed by the first terminal 120 or the second terminal 160 shown in FIG. 1, and the first terminal 120 or the second terminal 160 may be collectively referred to as a terminal. The method includes steps 202 to 212.

[0074] **Step 202:** Display a perspective screen of a first virtual character, where compass information is displayed on the perspective screen and includes an azimuth scale sequence.

[0075] The first virtual character is a virtual object controlled by a first user. The perspective screen of the first virtual character is a picture obtained by observing the virtual world from a perspective of the first virtual character when an application is running on the terminal. Optionally, the perspective screen of the first virtual character is a picture obtained by observing from a first-person perspective of the first virtual character in the virtual world.

[0076] Optionally, the first-person perspective of the first virtual character automatically follows the movement of the virtual character in the virtual world, i.e., the first-person perspective of the first virtual character changes with a position of the first virtual character in the virtual world, and the first-person perspective of the first virtual character is always within a preset distance range of the first virtual character in the virtual world.

[0077] The compass information includes an azimuth scale sequence, and the azimuth scale in the azimuth scale sequence indicates a horizontal azimuth that the first virtual character is facing in the virtual world. Exemplarily, azimuth scales of respective horizontal azimuths that can be observed in the virtual world from the perspective of the first virtual character are displayed in the azimuth scale sequence, and azimuth scales of horizontal azimuths that cannot be observed from the current perspective may not be displayed in the azimuth scale sequence. Alternatively, direction scales within a preset range with a horizontal azimuth directly in front of the first virtual character as a center are displayed in the azimuth scale sequence.

[0078] Exemplarily, as shown in FIG. 3, a first virtual character 10, a movement wheel 12, a skill button 14, and compass information 16 are displayed on the perspective screen. The first virtual character 10 may be a soldier located in the virtual world. The movement wheel 12 is used for controlling the movement of the first virtual character 10 in the virtual world, and the skill button 14 is used for controlling the first virtual character 10 to release skills or use articles in the virtual world. The compass information 16 displays an azimuth scale sequence. The azimuth scale sequence includes 7 azimuth scales: 165 degrees, south, 195 degrees, 215 degrees, southwest, 240 degrees, and 255 degrees. The azimuth scale of 215 degrees indicates the horizontal azimuth directly in front of the first virtual character 10.

[0079] **Step 204:** Control the first virtual character to act in the virtual world.

[0080] The user may control the first virtual character 10 to move by the movement wheel 12, or the user may control the first virtual character to release skills or use articles by pressing one

or more preset skills buttons 14. The user may also control the first virtual character by a signal generated by a long press, click, double click and/or slide on the touch screen.

[0081] **Step 206:** Determine a visual presentation of a first sound indicator according to a sound parameter of a first sound, if there is a first sound source in surroundings of the first virtual character during action of the first virtual character in the virtual world, the first sound being produced by the first sound source.

[0082] The visual presentation of the first sound indicator includes at least one of the following visual presentations:

[0083] a first visual presentation indicating a vertical azimuth of the first sound;

[0084] a second visual presentation indicating a sound type of the first sound;

[0085] a third visual presentation indicating a sound volume of the first sound;

[0086] a fourth visual presentation indicating a sound distance of the first sound;

[0087] a fifth visual presentation indicating a frequency of action of the first sound.

[0088] Each visual presentation is a different type of visual presentation. Each visual presentation is one of a shape, a pattern, a color, a texture, text, an animation effect, a display-starting time, a display duration, and a fading-out time of the first sound indicator. Different visual presentations may be superimposed on the same sound indicator, and are used for conveying different sound information.

[0089] The display-starting time is a time instant when the first sound indicator appears on the user interface. The display duration is a total duration the first sound indicator is displayed on the user interface. The fading-out time is a duration from a transparency of the first sound indicator starts to decrease to the first sound indicator disappears from the user interface.

[0090] In a case that there is a first sound source in the surroundings of the first virtual character, the first sound source will trigger a sound event. If the first virtual character is a virtual character used by a user of a current terminal, and the first sound source is a sound source corresponding to another terminal, the another terminal synchronizes the sound event to the current terminal via a server; if the first sound source is a sound source corresponding to the current terminal, the current terminal generates the sound event.

[0091] The sound event has sound parameters and the terminal may determine the visual presentation of the first sound indicator according to a sound parameter of the first sound. The sound parameter includes, but is not limited to: at least one of a type of the first sound source, a

material of the first sound source, an equipment condition of the first sound source, a position of the first sound source, a sound type of the first sound, a sound volume of the first sound, and a frequency of action of the first sound source.

[0092] In some possible cases, there are many active objects in the virtual world, many of which may produce sound as a first sound source, and even one active object (i.e., one sound source) may produce multiple sounds. In order to facilitate accurate identification of the sound produced by the first sound source, in a case that the first sound source produces at least two sounds and a difference between generation times of the at least two sounds is less than a threshold, a sound with a maximum sound volume among the at least two sounds is determined as the first sound.

[0093] For example, in a case that the first virtual character fires while walking, since the sound volume of the firing event is greater than that of the walking event, the firing event is determined to be a first sound event, a sound indicator of the firing event is displayed, and a sound indicator of the walking event is disabled.

[0094] For example, in a case that the first sound source produces a new sound event and the sound volume of the new sound event is greater than the sound volume of the current sound event, only the sound indicator of the new sound event is displayed. For example, the first virtual character walks in place for several steps and immediately fires, and since the sound volume of the firing event is greater than the sound volume of the walking event, the firing event is determined as a first sound event, the sound indicator of the walking event disappears, and only the sound indicator of the firing event is displayed.

[0095] According to the method in the embodiment, in a case that at least two sounds are generated by the first sound source and the difference between the generation times of the at least two sounds is less than the threshold, the sound with the maximum sound volume among the at least two sounds is determined as the first sound, thereby reducing amount of unnecessary calculation on sound events with lower sound volumes, and improving accuracy of prompting for sound effects.

[0096] **Step 208:** Display the first sound indicator having the visual presentation based on a first azimuth scale in the azimuth scale sequence.

[0097] The terminal may display the first sound indicator having at least one visual presentation based on the first azimuth scale in the compass information.

[0098] The first sound indicator may be displayed at an appropriate position on the user interface according to the display position of the compass information on the user interface. For example, in a case that the compass information is displayed on a top portion of the user interface,

the first sound indicator is displayed below the first azimuth scale in the compass information; in a case that the compass information is displayed on a bottom portion of the user interface, the first sound indicator is displayed above the first azimuth scale in the compass information. Optionally, a center of the first sound indicator is aligned with the first azimuth scale, i.e., a central axis of the first sound indicator is aligned with the first azimuth scale.

[0099] Exemplarily, the visual presentation of the first sound indicator may include a first visual presentation indicating a vertical azimuth of the first sound. In one possible implementation, the visual presentation of the first sound indicator may include the first visual presentation along with other visual presentations, i.e., the terminal may display the first sound indicator having the first visual presentation and the other visual presentations based on the first azimuth scale. Other visual presentations include at least one of the following visual presentations:

[00100] a second visual presentation indicating a sound type of the first sound;

[00101] a third visual presentation indicating a sound volume of the first sound;

[00102] a fourth visual presentation indicating a sound distance of the first sound; and

[00103] a fifth visual presentation indicating a frequency of action of the first sound.

[00104] For the first visual presentation

[00105] The first visual presentation includes n first visual presentations in one-to-one correspondence with n vertical azimuths, n being a positive integer greater than 1. A client displays the first sound indicator with an i^{th} first visual presentation based on the first azimuth scale in the compass information, i being a positive integer no greater than n . The i^{th} first visual presentation indicates an i^{th} vertical azimuth corresponding to the first sound source. Exemplarily, the i^{th} visual presentation may include the i^{th} vertical azimuth marking the first sound indicator with an altitude to correspond to an altitude of the first sound source. Exemplarily, the n vertical azimuths may include an upper azimuth, a middle azimuth, and a lower azimuth, thereby enabling distinguishing between an upper level of space, a middle level of space and a lower level of space by the first sound indicator.

[00106] The first visual presentation enables a user to know the vertical azimuth of the first sound source by observing the visual presentation of the first sound indicator, and there may be one or more ways of visually representing the vertical azimuth of the first sound source. Exemplarily, the first visual presentation includes at least one of: a shape of the first sound indicator, a vertical azimuth scale in the first sound indicator, an arrow in the first sound indicator, and a text prompt in the first sound indicator.

[00107] The first visual presentation includes a shape, for example, and this step includes one of:

[00108] displaying an up-pointing first sound indicator based on the first azimuth scale in the azimuth scale sequence, the first sound indicator indicating that the vertical azimuth of the first sound source is the upper azimuth;

[00109] displaying a horizontally symmetrical first sound indicator based on the first azimuth scale in the azimuth scale sequence, the first sound indicator indicating that the vertical azimuth of the first sound source is the middle azimuth; and

[00110] displaying a down-pointing first sound indicator based on the first azimuth scale in the azimuth scale sequence, the first sound indicator indicating that the vertical azimuth of the first sound source is the lower azimuth.

[00111] Exemplarily, referring to FIG. 6, assuming that the first sound source is an enemy virtual character located on top of a building, since the enemy virtual character is in a vertical direction located at an upper azimuth of the first virtual character 10, a first sound indicator having an up-pointing shape is displayed below the first azimuth scale “215” in the compass information 16 to indicate that the vertical azimuth of the first sound is the upper azimuth.

[00112] In contrast to FIG. 6, if the first virtual character 10 is located on top of the building and the enemy virtual character is located on the ground of the building, the vertical azimuth of the first sound source is the lower azimuth.

[00113] The first visual presentation includes a vertical azimuth scale for example, and a first sound indicator having a vertical azimuth scale is displayed based on the first azimuth scale in the azimuth scale sequence, where the vertical azimuth scale indicates the vertical azimuth of the first sound source or a pitch angle of the first sound source relative to the first virtual character. That is, the vertical azimuth scale is represented by the pitch angle of the first sound source relative to the first virtual character.

[00114] The first visual presentation includes an arrow for example, and a first sound indicator having an arrow is displayed based on the first azimuth scale in the azimuth scale sequence, where an arrow direction of the arrow indicates the vertical azimuth of the first sound source. For example, an up-pointing arrow indicates an upper azimuth with a height greater than that of a plane on which the first virtual character is located, and a down-pointing arrow indicates a lower azimuth with a height smaller than that of the plane on which the first virtual character is located.

[00115] The first visual presentation includes a text prompt, for example, and a first sound indicator having a text prompt is displayed based on the first azimuth scale in the azimuth scale sequence, where the text prompt indicates the vertical azimuth of the first sound source.

[00116] The first visual presentation may be implemented as a combination of at least two of the above shape, vertical azimuth scale, arrow, and text prompt, which is not limited.

[00117] For the second visual presentation

[00118] The second visual presentation indicates the sound type of the first sound. In this case, determining the visual presentation of the first sound indicator according to the sound parameter of the first sound may be determining the second visual presentation of the first sound indicator according to the sound type of the first sound.

[00119] In some embodiments, the second visual presentation includes a color of the first sound indicator, i.e., the color of the first sound indicator indicates the sound type of the first sound. For example, a footstep/NPC cry of a virtual character is represented by white, and a gunshot/explosion is represented by red.

[00120] Exemplarily, referring to FIG. 7, two sound indicators 19a and 19b are displayed on a user interface for two sounds from different sound sources. The sound indicator 19a is white, representing a footstep; the sound indicator 19b is red, representing a gunshot.

[00121] In some embodiments, the second visual presentation includes an icon pattern of the first sound indicator, i.e., the icon pattern of the first sound indicator indicates the sound type of the first sound.

[00122] Exemplarily, referring to FIG. 8, the sound type “gunshot” is represented by a gun icon pattern 191; the sound type “footstep” is represented by a footprint icon pattern 192; the sound type “human voice” is represented by a human head icon pattern 193; and the sound type “explosion” is represented by an explosion icon pattern 194.

[00123] In some embodiments, the second visual presentation is a display duration of the first sound indicator. The display duration includes: a first duration of the first sound indicator in a non-transparent manner, and a second duration (i.e., fading-out duration) of cancelling display by gradually changing from the non-transparent manner to a transparent manner. That is, the sound type of the first sound is indicated by the display duration. For example, different sound types correspond to different first durations; or, different sound types correspond to different second durations; or different sound types correspond to different first and second durations.

[00124] For the third visual presentation

[00125] The third visual presentation indicates the sound volume of the first sound.

Exemplarily, the sound volume of the first sound refers to an arriving sound volume of the first sound at the first virtual character to simulate a sound volume of the first sound actually heard by the first virtual character, rather than an original sound volume of the first sound. In this case, the first sound indicator is represented by an acoustic amplitude spectrum, the third visual presentation includes an amplitude of the first acoustic amplitude spectrum, and the sound parameter includes a sound volume. Determining the visual presentation of the first sound indicator according to the sound parameter of the first sound may be determining the amplitude of the first acoustic amplitude spectrum according to the arriving sound volume of the first sound at the first virtual character.

[00126] Exemplarily, referring to FIG. 7, a sound indicator is represented by an acoustic amplitude spectrum, the height of which represents the acoustic amplitude. Two sound indicators 19a and 19b are displayed on a user interface for two sounds from different sound sources. The acoustic amplitude of the sound indicator 19a is less than the acoustic amplitude of the sound indicator 19b, and the sound volume corresponding to the sound indicator 19a is less than the sound volume corresponding to the sound indicator 19b, where the two sounds are a footstep and a gunshot at the same distance. The sound indicator 19a on the left has a smaller acoustic amplitude and the sound indicator 19b on the right has a larger acoustic amplitude.

[00127] Exemplarily, referring to FIG. 9, a sound indicator is represented by an acoustic amplitude spectrum, the height of which represents the acoustic amplitude. Different acoustic amplitudes represent two sounds of different sound volumes. FIG. 9 shows that within a distance range of 100-200 m, the amplitude of the first sound indicator weakens as the gunshot weakens with distance.

[00128] **For the fourth visual presentation**

[00129] The fourth visual presentation indicates the sound distance of the first sound. Exemplarily, the fourth visual presentation is represented by a display-starting time of the first sound indicator. That is, the first sound indicator is not displayed immediately upon receiving the sound event of the first sound, but is displayed after a certain delay. The duration of the delay is related to a sound distance, which is a distance between the first sound source and the first virtual character.

[00130] **For the fifth visual presentation**

[00131] The fifth visual presentation indicates a frequency of action of the first sound. Exemplarily, the first sound indicator is represented by an acoustic amplitude spectrum, and the

fifth visual presentation includes a jitter frequency of the acoustic amplitude spectrum. The height of the acoustic amplitude spectrum represents the acoustic amplitude, and the acoustic amplitude spectrum is capable of dynamically scaling to represent the jitter of the acoustic wave. Since the amplitude of the action for generating the first sound is different, the frequency of the action of the first sound is also different. In this case, the sound parameter includes a frequency of action of the first sound source, and determining the visual presentation of the first sound indicator according to the sound parameter of the first sound may be determining the jitter frequency of the acoustic amplitude spectrum according to the frequency of action of the first sound source when producing the first sound.

[00132] For example, when the virtual character located at the first sound source is running, the acoustic amplitude spectrum is displayed in white, and the jitter frequency of the acoustic amplitude spectrum is greater to show a hurry of running. When the virtual character located at the first sound source slows down to walk while squatting, the frequency of the jitter of the acoustic amplitude spectrum is smaller, to show the sensation of slow movement and to distinguish from running.

[00133] **Step 210:** Display a second sound indicator based on an edge azimuth scale in the azimuth scale sequence closest to a horizontal azimuth of a second sound source if there is the second sound source in the surroundings of the first virtual character and the horizontal azimuth of the second sound source is out of a visible azimuth range, the second sound indicator indicating the presence of the second sound source beyond a horizontal azimuth indicated by the edge azimuth scale.

[00134] There may also be a second sound source in the surroundings of the first virtual character, and before the second sound indicator is displayed below the azimuth scale sequence, it is determined whether a horizontal azimuth (which may also be referred to as a second horizontal azimuth) corresponding to the second sound source is within a visible azimuth range of the first virtual character.

[00135] In a case that the horizontal azimuth corresponding to the second sound source is within the visible azimuth range of the first virtual character, a second sound indicator is displayed based on a second azimuth scale in the azimuth scale sequence, for example, horizontal and vertical azimuths of a second sound are indicated by a second acoustic amplitude spectrum.

[00136] In a case that the horizontal azimuth corresponding to the second sound source is out of the visible azimuth range of the first virtual character, a second sound indicator is displayed

based on the edge azimuth scale in the azimuth scale sequence closest to the horizontal azimuth of the second sound source to indicate the presence of the second sound source or the second sound.

[00137] Exemplarily, as shown in FIG. 10, within a visible range of the first virtual character 10, a second sound indicator 19 is displayed based on an edge azimuth scale on the compass information 18. The second sound indicator 19 may be aligned with or beyond the edge azimuth scale. The second sound indicator 19 indicates that there is a second sound source in an invisible region to the right of the first virtual character 10 and that the second sound source produces the second sound.

[00138] Optionally, the second sound indicator 19 has at least one of the five visual presentations described above. The number of types of visual presentations of the second sound indicator 19 is equal to or less than that of the first sound indicator. For example, the second sound indicator 19 only displays a sound type of the second sound by a color or an icon pattern.

[00139] **Step 212:** Cancel or disregard displaying of a (first) sound indicator when the first virtual character enters a deaf state.

[00140] When the first virtual character is attacked by a first sound projectile and enters a deaf state due to receiving a sound too large, the first virtual character cannot hear a sound in the terminal. While the first virtual character is in the deaf state, the terminal cancels displaying of the first sound indicator below the azimuth scale sequence in the compass information, i.e., cancel displaying of all sound indicators corresponding to the first virtual character.

[00141] The first sound projectile is a grenade or a bomb. The first virtual character may enter a deaf state when a grenade explodes near the first virtual character.

[00142] In summary, according to the method in the embodiment, by merely displaying the first sound indicator based on the first azimuth scale in the azimuth scale sequence in a case there is the first sound source in the surroundings of the first virtual character, the first horizontal azimuth and the first vertical azimuth corresponding to the first sound source can simultaneously be indicated by the first sound indicator, so that a user can accurately determine the spatial position of the first sound source merely by means of visual presentation, without the mini-map to show the position, and acquire sufficient and effective spatial information for the sound source in an auditory-limited scene without the need of loud-speaking or using headphones.

[00143] According to the method in the embodiment, the vertical azimuth, sound type, sound volume, sound distance and frequency of action of the sound are respectively indicated through different visual presentations existing on the first sound indicator at the same time, so that a user

can obtain the vertical azimuth, sound type, sound volume, sound distance and frequency of action of the first sound merely by the different visual presentations, and obtain effective information about the first sound in an auditory-limited scene without the need of loud-speaking or using headphones. Besides, as the first sound indicator occupies a very small area on the user interface, display space on the user interface can be saved. In addition, a sound can be prompted for in many aspects merely based on various visual presentations of the first sound indicator for a compass without a mini-map to prompt for locations, thereby bringing more immersive gaming experience for the user.

[00144] The method according to the embodiment also improves an accuracy of determination of the spatial position of the first sound source by the user merely by means of the visual presentation, through canceling or disregarding the displaying of the (first) sound indicator in a case that the first virtual character enters the deaf state.

[00145] For the five types of visual presentations described above, the above step 205 may optionally include at least one of the steps described hereinafter.

[00146] For the first visual presentation

[00147] A pitch angle of the first sound source relative to the first virtual character is calculated according to positions of the first sound source and the first virtual character in the virtual environment, and the vertical azimuth of the first sound source is determined based on a value of the pitch angle.

[00148] Exemplarily, as shown in FIG. 11, the vertical azimuth of the first sound source is determined according to the pitch angle. In a case that the pitch angle of the first sound source relative to the first virtual character is in a range of -17° to 17° or 163° to 180° or -163° to -180° , the vertical azimuth of the first sound source is determined to be a middle azimuth relative to the first virtual character; in a case that the pitch angle of the first sound source relative to the first virtual character is in a range of 17° to 163° , the vertical azimuth of the first sound source is determined to be an upper azimuth relative to the first virtual character; in a case that the pitch angle of the first sound source relative to the first virtual character is in a range of -17° to -163° , the vertical azimuth of the first sound source is determined to be a lower azimuth relative to the first virtual character.

[00149] For the second visual presentation.

[00150] In a case that the second visual presentation includes the color of the first sound indicator, the color of the first sound indicator is determined according to the sound type of the first sound.

[00151] Exemplarily, as shown in Table I, a first correspondence between sound types and colors is shown.

Table I

Color	Sound type
White	Footstep
Red	Gunshot
Orange	Explosion
Blue	Cry

[00152] By querying the first correspondence, the terminal can determine a color corresponding to the sound type of the first sound and determine the color as the color of the first sound indicator.

[00153] In a case that the second visual presentation includes the icon pattern of the first sound indicator, the icon pattern of the first sound indicator is determined according to the sound type of the first sound.

[00154] Exemplarily, as shown in Table II, a second correspondence between sound types and icon patterns is shown.

Table II

Icon pattern	Sound type
Footprint icon pattern	Footstep
Gun icon pattern	Gunshot
Flame icon pattern	Explosion
Human head icon pattern	Cry

[00155] By querying the second correspondence, the terminal can determine an icon pattern corresponding to the sound type of the first sound and determine the icon pattern as the icon pattern of the first sound indicator.

[00156] For the third visual presentation

[00157] The first sound indicator is represented by an acoustic amplitude spectrum and the third visual presentation includes an amplitude of the first acoustic amplitude spectrum.

[00158] Step 1: Determine an arriving sound volume of the first sound according to an original sound volume of the first sound and an influence parameter, the influence parameter including at least one of the following parameters:

[00159] a distance between the first sound source and the first virtual character, equipment worn by the first virtual character, equipment worn by the second virtual character in a case that the first sound source is the second virtual character, and a material of the first sound source or a material in contact with the first sound source.

[00160] A sound volume is attenuated by a propagation distance. Therefore, the longer the distance between the first sound source and the first virtual character is, the smaller the sound volume of the first sound is; the shorter the distance between the first sound source and the first virtual character is, the larger the sound volume of the first sound is.

[00161] The equipment worn by the first virtual character relating to the sound volume includes: at least one of different types of helmets and headphones. Both the type of equipment and a wearing status of the equipment affect the sound volume of the first sound.

[00162] Exemplarily, for a sound volume of a same original sound, an arriving sound volume in a case that the first virtual character is wearing an earphone is larger than an arriving sound volume in a case that the first virtual character is not wearing the earphone; and an arriving sound volume in a case that the first virtual character is wearing a helmet is smaller than an arriving sound volume in a case that the first virtual character is not wearing the helmet.

[00163] The equipment worn by the second virtual character relating to the sound volume includes: at least one of different types of guns, different ammunition types, and mufflers. Both a type of equipment and a wearing status of the equipment affect the sound volume of the first sound.

[00164] Exemplarily, for a sound volume of a same original sound, an arriving sound volume in a case that the second virtual character is equipped with a muffler is smaller than an arriving sound volume in a case that the second virtual character is not equipped with the muffler.

[00165] For example, a sound of shoes of the first virtual character touching different grounds may affect the sound volume, and a sound of the shoes of the first virtual character made of different materials touching a same ground may affect the sound volume.

[00166] Exemplarily, the arriving sound volume = (original sound volume * influence coefficient of original sound volume) * (1-sound distance/(maximum effective distance of sound * influence coefficient of maximum distance)).

[00167] The original sound volume is a sound volume of the first sound at the first sound source. Exemplarily, the influence coefficient of the original sound volume is related to the above-described influence parameter and is usually set as an empirical value by a designer. The influence coefficient at the maximum distance of the sound indicates sound attenuation characteristics and is related to the above-described influence parameter, which is usually set to an empirical value by the designer.

[00168] For example, the first virtual character wears a sound-insulating helmet and hears a gunshot with a muffler 75m away. An original sound volume is 100 and a maximum effective distance is 150m. An influence coefficient of the muffler on an original sound volume is 1, and an influence coefficient of the muffler on the maximum distance is 0.5; an influence coefficient of the helmet for the original sound volume is 0.5 and an influence coefficient of the helmet at the maximum distance is 0.5.

[00169] The arriving sound volume = $(100 * 1 * 0.5) * (1 - 75 / (150 * 0.5 * 0.5)) = 50 * 1 = 50$ = negative value made zero = no sound is heard, so no ripple is displayed on the first sound indicator.

[00170] In another example, the first virtual character wears a sound-insulating helmet and hears a gunshot with a muffler 30m away, where an original sound volume is 100 and a maximum effective distance is 150m.

[00171] The arriving sound volume = $(100 * 0.5) * (1 - 30 / (150 * 0.5 * 0.5)) = 50 * 0.2 = 25$.

[00172] **Step 2:** Determine an amplitude of the first acoustic amplitude spectrum according to the arriving sound volume of the first sound at the first virtual character.

[00173] The client maps the arriving sound volume of the first sound to an acoustic amplitude of the first acoustic amplitude spectrum according to a “sound volume- acoustic amplitude” conversion curve.

[00174] For example, a volume of a rifle gunshot at 150m away from the player is $100 * (1 - 150 / 200) = 25$, and the value 25 is converted into an acoustic amplitude of 0.22 according to a conversion curve, so that the acoustic amplitude of the first acoustic amplitude spectrum is influenced at a magnification factor of 0.22.

[00175] **For the fourth visual presentation**

[00176] In a case that the fourth visual presentation includes the display-starting time of the first sound indicator, the display-starting time of the first sound indicator is determined based on a sound propagation speed between the first sound source and the first virtual character, where the display-starting time is later than a generation time of the first sound.

[00177] Exemplarily, display-starting time = generation time of the first sound + sound distance/sound propagation speed in the virtual environment,

[00178] where the generation time of the first sound is the time when the first sound is produced by the first sound source, the sound distance is the distance between the first sound source and the first virtual character, and the sound propagation speed in the virtual environment is usually set as an empirical value by a designer.

[00179] **For the fifth visual presentation**

[00180] The first sound indicator is represented by the acoustic amplitude spectrum, the fifth visual presentation includes the jitter frequency of the acoustic amplitude spectrum, and the jitter frequency of the acoustic amplitude spectrum is determined according to the frequency of action of the first sound source when producing the first sound.

[00181] Exemplarily, when the virtual character is running, the acoustic amplitude spectrum is displayed in white, and the jitter frequency of the acoustic amplitude spectrum is greater to show a hurry of running; when the first virtual character slows down to walk while squatting, the jitter frequency of the acoustic amplitude spectrum is smaller to show the sensation of slow movement and to distinguish from running.

[00182] The sequence of the above calculations is not limited in the present application.

[00183] In some embodiments, a developer may configure the influence coefficients of the tactical prop and equipment on the arriving sound volume of the first sound in the above-described embodiments. Exemplarily, referring to FIG. 12, a configuration interface 1200 of an influence coefficient of a helmet or a headphone on the arriving sound volume of the first sound is shown. The configuration interface 1200 includes three configurable items, an increased acoustic amplitude coefficient 1201, a sound volume influence coefficient 1202 and influence coefficient at the maximum distance of the sound 1203. The configurable item of the increased acoustic amplitude coefficient 1201 is used for configuring an influence coefficient for the acoustic amplitude of the first sound when the first virtual character is wearing the helmet or the headphone, the configurable item of the sound volume influence coefficient 1202 is used for configuring an influence coefficient for the arriving sound volume of the first sound when the first virtual character wears the helmet or

the headphone, and the configurable item of the influence coefficient at the maximum distance of the sound 1203 is used for configuring an influence coefficient for the maximum distance the first sound may propagate when the first virtual character is wearing the helmet or the headphone. Exemplarily, both the configurable items of the sound volume influence coefficient 1202 and the influence coefficient at the maximum distance of the sound 1203 are 1, and the first virtual character wearing the helmet or the headphone has no influence on the arriving sound volume and the maximum distance of the first sound.

[00184] FIG. 13 shows a configuration interface 1300 of an influence coefficient of a muffler on the arriving sound volume of the first sound. The configuration interface 1300 includes two configurable items, a sound volume influence coefficient of the muffler 1301 and an influence coefficient at the maximum distance of the sound of the muffler 1302. The configurable item of the sound volume influence coefficient of the muffler 1301 is used for configuring an influence coefficient for the arriving sound volume of the first sound when the first virtual character is equipped with the muffler, and the configurable item of the influence coefficient at the maximum distance of the sound of the muffler 1302 is used for configuring an influence coefficient for the maximum distance that the first sound may propagate when the first virtual character is equipped with the muffler. Exemplarily, the sound volume influence coefficient of the muffler 1301 is 1, and the first virtual character being equipped with the muffler has no influence on the arriving sound volume of the first sound.

[00185] FIG. 14 shows a configuration interface 1400 of an influence coefficient of a treaded-on material on the arriving sound volume of the first sound. The configuration interface 1400 includes two configurable items for a marble metal material 1410, a sound volume influence coefficient 1401 and an influence coefficient at the maximum distance of the sound 1402. The configurable item of the sound volume influence coefficient 1401 is used for configuring an influence coefficient for the arriving sound volume of the first sound when the first virtual character steps on the ground of the marble metal material, and the configurable item of the influence coefficient at the maximum distance of the sound 1402 is used for configuring an influence coefficient for the maximum distance that the first sound may propagate when the first virtual character steps on the ground of the marble metal material. Exemplarily, the sound volume influence coefficient 1401 and the influence coefficient at the maximum distance of the sound 1402 are both 1, and the first virtual character stepping on the ground of the marble metal material has no influence on the arriving sound volume and the maximum distance of the first sound.

[00186] In some embodiments, the developer may configure influence coefficients of different sound types described in the above embodiments on the first sound. Exemplarily, referring to FIG. 15, a configuration interface 1500 for different sound types and basic configuration parameters is shown. The configuration interface 1500 includes eight configurable parameters, a basic sound volume 1520, a sound icon displaying time 1530, a sound icon fading-out time 1540, an icon index 1550, a sound icon refresh interval 1560, a maximum valid sound range 1570, an jitter frequency of acoustic waveform 1580 and an opacity curve 1590, for each of the sound types including sprint 1501, climb 1502, squat walk 1503, silent walk 1504, silent climb 1505, silent squat walk 1506, single shot 1507, continuous shots 1508, NPC cry 1509, grass smear 1510, cry due to wound 1511, dying cry 1512, explosion 1513 and walk 1514.

[00187] In some embodiments, a developer may configure configuration parameters corresponding to different gun types described in the embodiments above. Exemplarily, referring to FIG. 16, a configuration interface 1600 for configuration parameters corresponding to different gun types is shown, which may be varied by addition or subtraction based on gunshot types. The configuration interface includes a configuration interface 1600 for basic single shot parameters, a parameter configuration interface 1601 for a pistol and a parameter configuration interface 1602 for a bolt-action rifle on a single shot basis. The configuration interface for basic single shot parameters includes a basic sound volume 1620, a sound icon displaying time 1630, a sound icon fading-out time 1640, an icon index 1650, a sound icon refresh interval 1660, a maximum valid sound range 1670, and a jitter frequency of acoustic waveform 1680. The configurable item of the maximum valid sound range 1670 on the configuration interface for the pistol is -100m, which indicates that the maximum valid sound range 1670 of the pistol is 100m less than that of a single shot which is 200m and the configurable item of the maximum valid sound range 1670 for the pistol is 100m. The basic sound volume 1620, the sound icon displaying time 1630, the sound icon fading-out time 1640, the sound icon refresh interval 1660 and the jitter frequency of acoustic waveform 1680 are the same as those for the single shot. The configurable item of the basic sound volume 1620 of the bolt-action rifle on the configuration interface is 20, the configurable item of the sound icon fading-out time 1640 is 0.3; the configurable item of the basic sound volume 1620 of the bolt-action rifle is 20 larger than that of the single shot, and the configurable item of the sound icon fading-out time 1640 of the bolt-action rifle is 0.3 larger than that of the single shot; and the maximum valid sound range 1670, the sound icon displaying time 1630, the sound icon refresh interval 1660, and the jitter frequency of acoustic waveform 1680 of the bolt-action rifle 1670 are the same as those for the single shot.

[00188] In some embodiments, the developer may configure general configuration parameters described in the above embodiments. Exemplarily, referring to FIG. 17, a configuration interface 1700 for general configuration parameters is shown. The configuration interface 1700 includes a maximum number of displayed sound ripples 1710, an Icon display angle threshold 1720, an upper angle threshold 1730, a lower angle threshold 1740, a firearm sound icon color 1750, a character sound icon color 1760, and a mapping curve 1770 of sound ripple height and sound volume. The configurable item of the Icon display angle threshold 1720 is 90°, and a sound icon of a valid sound source within a coverage range of a left-right rotation of 90° of camera shooting of the first virtual character is displayed by default. The mapping curve 1770 of sound ripple height and sound volume can convert the arriving sound volume of the first sound into a mapping curve of the first sound, where a horizontal axis thereof represents a sound intensity and a vertical axis thereof represents a waveform height. In summary, according to the method in the embodiment, by displaying the first sound indicator based on the first azimuth scale in the azimuth scale sequence in a case there is the first sound source in the surroundings of the first virtual character, the first horizontal azimuth and the first vertical azimuth corresponding to the first sound source can simultaneously be indicated by the first sound indicator, so that a user can accurately determine the spatial position of the first sound source merely by means of visual presentation, and acquire sufficient and effective spatial information for the sound source in an auditory-limited scene without the need of loud-speaking or using headphones.

[00189] According to the method in the embodiment, an attribute of the first sound source can be further distinguished according to the sound indicator and the amplitude, jitter frequency and duration of the acoustic amplitude spectrum below the sound indicator. The vertical azimuth of the first sound source in the virtual world is determined according to the comparison between a sound source angle and the pitch angle, thereby improving prompting effects on the sound volume, sound frequency and sound type.

[00190] FIG. 18 is a flowchart of a method for prompting for a sound in a virtual world according to an exemplary embodiment of the present application. The method may be performed by the first terminal 120 or the second terminal 160 shown in FIG. 1, and the first terminal 120 or the second terminal 160 may be collectively referred to as a terminal. The method includes steps 1802 to 1822.

[00191] **Step 1802:** Obtain a parameter of a first sound.

[00192] The terminal obtains a parameter of a first sound produced by a first sound source. Put it another way, the terminal obtains a parameter of a sound event of the first sound produced by the first sound source.

[00193] **Step 1804:** Identify a sound type of the first sound.

[00194] A sound type of the first sound is determined according to the sound parameter of the first sound obtained by the terminal, and corresponding second visual presentations carried by a first sound indicator are determined according to different sound types.

[00195] In some embodiments, the second visual presentation is a color. If it is determined that the first sound is a footstep/NPC cry of the virtual character according to the sound parameter of the first sound obtained by the terminal, the first sound indicator is represented in white; if it is determined that the first sound is a gunshot/explosion sound, the first sound indicator is represented in red.

[00196] In some embodiments, the second visual presentation is an icon pattern, the type of the first sound is determined according to the sound parameter of the first sound obtained by the terminal, and an icon pattern corresponding to the first sound represents the first sound indicator. For example, if it is determined that the first sound is a footstep of the virtual character, the first sound indicator is represented by a footprint icon pattern; if it is determined that the first sound is a gunshot, the first sound indicator is represented by a gun icon pattern.

[00197] **Step 1806a:** Calculate an arriving sound volume according to a distance between the first sound source configured according to the type of the first sound and the first virtual character and an original sound volume of the first sound source.

[00198] The sound event of the first sound carries three-dimensional coordinates of the first sound source. The terminal can calculate a distance between the first sound source and the first virtual character by calculating the distance between the three-dimensional coordinates of the first sound source and three-dimensional coordinates of the first virtual character.

[00199] Since a sound volume is attenuated by a propagation distance, the longer the distance between the first sound source and the first virtual character is, the smaller the sound volume of the first sound is; the shorter the distance between the first sound source and the first virtual character is, the larger the sound volume of the first sound is.

[00200] The sound event of the first sound also carries an original sound volume of the first sound source, and the terminal attenuates the original sound volume of the first sound by using the distance as an influence parameter.

[00201] **Step 1806b:** Calculate an arriving sound volume according to an influence parameter including a tactical prop and equipment.

[00202] The terminal determines a corresponding influence coefficient according to the influence parameter such as a tactical prop and equipment, and then calculates a final arriving sound volume of the first sound.

[00203] Exemplarily, the tactical prop and equipment (which may be collectively referred to as equipment) include:

[00204] equipment worn by the first virtual character; equipment worn by a second virtual character in a case that the first sound source is the second virtual character; and a material of the first sound source or a material in contact with the first sound source.

[00205] The equipment worn by the first virtual character relating to the sound volume includes: at least one of different types of helmets and headphones. Both a type of equipment and a wearing status of the equipment affect the sound volume of the first sound.

[00206] The equipment worn by the second virtual character relating to the sound volume includes: at least one of different types of guns, different ammunition types, and mufflers. Both the type of equipment and the wearing status of the equipment affect the sound volume of the first sound.

[00207] For example, a sound of shoes of the first virtual character touching different grounds may affect the sound volume, and a sound of the shoes of the first virtual character made of different materials touching a same ground may affect the sound volume.

[00208] Exemplarily, the arriving sound volume = (original sound volume * influence coefficient of original sound volume) * (1-sound distance/(maximum effective distance of sound * influence coefficient of maximum distance)).

[00209] The original sound volume is a sound volume of the first sound at the first sound source. Exemplarily, the influence coefficient of the original sound volume is related to the above-described influence parameter and is usually set as an empirical value by a designer. The influence coefficient at the maximum distance of the sound indicates sound attenuation characteristics and is related to the above-described influence parameter, which is usually set to an empirical value by the designer.

[00210] For example, the first virtual character wears a sound-insulating helmet and hears a gunshot with a muffler 75m away. An original sound volume is 100 and a maximum effective distance is 150m. An influence coefficient of the muffler on an original sound volume is 1, and an

influence coefficient of the muffler on the maximum distance is 0.5; an influence coefficient of the helmet for the original sound volume is 0.5 and an influence coefficient of the helmet at the maximum distance is 0.5.

[00211] The arriving sound volume = $(100 * 1 * 0.5) * (1 - 75 / (150 * 0.5 * 0.5)) = 50 * -1 = -50$ = negative value made zero = no sound is heard, so no ripple is displayed on the first sound indicator.

[00212] In another example, the first virtual character wears a sound-insulating helmet and hears a gunshot with a muffler 30m away, where an original sound volume is 100 and a maximum effective distance is 150m.

[00213] The arriving sound volume = $(100 * 0.5) * (1 - 30 / (150 * 0.5 * 0.5)) = 50 * 0.2 = 25$.

[00214] It should be noted that the calculations in step 1806a and step 1806b may be performed simultaneously, or the sound volume before being influenced by the tactical prop and the equipment may be calculated as an intermediate value according to the distance between the first sound source and the first virtual character and the original sound volume of the first sound source, and then the final arriving sound volume subjected to influence of the tactical prop and the equipment may be calculated.

[00215] **Step 1808:** Determine whether a horizontal azimuth of the first sound source is within a visible azimuth range corresponding to an azimuth scale sequence displayed in the compass information.

[00216] The compass information includes an azimuth scale sequence, and azimuth scales in the azimuth scale sequence indicate horizontal azimuths that the first virtual character is facing in the virtual world. Exemplarily, azimuth scales of respective horizontal azimuths that can be observed in the virtual world from a perspective of the first virtual character are displayed in the azimuth scale sequence, and azimuth scales of horizontal azimuths that cannot be observed from the current perspective may not be displayed in the azimuth scale sequence. Alternatively, direction scales within a preset range with a horizontal azimuth directly in front of the first virtual character as a center is displayed in the azimuth scale sequence.

[00217] If the horizontal azimuth of the first sound source is not within the visible azimuth range corresponding to the azimuth scale sequence displayed in the compass information, step 1810 is performed to represent a sound by a second sound indicator; if the horizontal azimuth of the first sound source is within the visible azimuth range corresponding to the azimuth scale sequence

displayed in the compass information, step 1812 is performed to determining whether it is above/below the first virtual character according to a pitch angle.

[00218] Step 1810: Represent a sound by a second sound indicator.

[00219] A second sound indicator is displayed based on an edge azimuth scale in the azimuth scale sequence closest to a second horizontal azimuth, if it is determined that the horizontal azimuth of the first sound source is not within the visible azimuth range corresponding to the azimuth scale sequence displayed in the compass information, and the sound is determined as a second sound or a second sound source and is represented by the second sound indicator. .

[00220] Step 1812: Determine whether the first sound source is above/below the first virtual character according to a pitch angle.

[00221] A pitch angle of the first sound source relative to the first virtual character is calculated according to position coordinates of the first sound source and the first virtual character in the virtual environment obtained by the terminal, and a vertical azimuth of the first sound source is determined based on a value of the pitch angle.

[00222] In a case that the first sound source is above/below the first virtual character, step 1814 is executed, and the sound is represented by a first sound indicator above/below. That is, in a case that the first sound source is above the first virtual character, a first sound indicator above is displayed to represent that the first sound source is above the first virtual character, and in a case that the first sound source is below the first virtual character, a first sound indicator below is displayed to represent that the first sound source is below the first virtual character. In a case that the first sound source is not above/below the first virtual character, step 1816 is performed to represent the sound by a first sound indicator in the middle. That is, in a case that the first sound source is within a vertical dimension of the first virtual character, a first sound indicator in the middle is displayed to represent that the first sound source is within a vertical dimension of the first virtual character.

[00223] Exemplarily, as shown in FIG. 11, the first character is determined to be within the vertical dimension of the first virtual character in a case that the pitch angle of the first sound source relative to the first virtual character is in a range of -17° to 17° or 163° to 180° or -163° to -180° ; the first character is determined to be above the first virtual character in a case that the pitch angle of the first sound source relative to the first virtual character is in a range of 17° to 163° ; and the first character is determined to be below the first virtual character in a case that the pitch angle of the first sound source relative to the first virtual character is in a range of -17° to -163° .

[00224] **Step 1814:** Represent the sound by a first sound indicator above or below.

[00225] **Step 1816:** Represent the sound by a first sound indicator in the middle.

[00226] **Step 1818:** Determine whether the first sound is a gunshot.

[00227] It is determined whether the first sound is a gunshot according to the sound parameter of the first sound obtained by the terminal. In a case that the first sound is a gunshot, step 1820 is performed to represent the first sound differentially according to a gunshot type; and if it is determined that the first sound is not a gunshot, step 1822 is performed to represent the first sound differentially according to a character and another sound type.

[00228] **Step 1820:** Differentially represent the first sound according to a gunshot type.

[00229] Exemplarily, the terminal determines that the first sound is a gunshot according to the sound parameter of the first sound, determines the first sound indicator of the first sound as a red color or as an icon pattern of a gun, and determines an acoustic amplitude, an acoustic wave vibration frequency and an acoustic wave duration of the first sound indicator according to the parameter of the first sound.

[00230] **Step 1822:** Differentially represent the first sound according to a virtual character and another sound type.

[00231] Exemplarily, the terminal determines that the first sound source is a virtual character according to the sound parameter of the first sound, determines the first sound indicator of the first sound as a white color, a footprint icon pattern or a human head icon pattern, and then determines the acoustic amplitude, the acoustic wave vibration frequency, and the acoustic wave duration of the first sound indicator according to the parameter of the first sound.

[00232] In summary, according to the method in the embodiment, the type of the first sound is identified the sound parameter of the first sound obtained by the terminal, the arriving sound volume of the first sound is calculated according to the distance between the first sound source and the first virtual character and the original sound volume of the first sound source, and the horizontal azimuth and the vertical azimuth of the first sound is determined by determining whether the first sound is in the azimuth scale range displayed in the compass information, thereby improving prompt effects on sound volume, sound frequency and sound type.

[00233] FIG. 19 is a structural block diagram of an apparatus for prompting for a sound in a virtual world according to an exemplary embodiment of the present application. The apparatus may be implemented in software, hardware, or a combination of both as all or part of a computer device. The apparatus 1900 includes:

[00234] a display module 1901, configured to display a perspective screen of a first virtual character, compass information being displayed on the perspective screen, the compass information including an azimuth scale sequence, and an azimuth scale in the azimuth scale sequence indicating a horizontal azimuth that the first virtual character faces in the virtual world; and

[00235] a control module 1902, configured to control the first virtual character to act in the virtual world,

[00236] the display module 1901 being further configured to display a first sound indicator based on a first azimuth scale in the azimuth scale sequence if there is a first sound source in surroundings of the first virtual character during the action of the first virtual character in the virtual world, the first sound indicator indicating a horizontal azimuth and a vertical azimuth corresponding to the first sound source.

[00237] In an optional design according to an embodiment, the display module 1901 is configured to display a first sound indicator having a visual presentation based on the first azimuth scale in the azimuth scale sequence, where a center of the first sound indicator is aligned with the first azimuth scale, the first azimuth scale indicates a horizontal azimuth of the first sound source, and the visual presentation of the first sound indicator indicates the vertical azimuth of the first sound source.

[00238] In an optional design according to an embodiment, the visual presentation of the first sound indicator includes a first visual presentation indicating the vertical azimuth of the first sound source, and the first visual presentation includes at least one of: a shape of the first sound indicator, a vertical azimuth scale in the first sound indicator, an arrow in the first sound indicator, and a text prompt in the first sound indicator.

[00239] In an optional design according to an embodiment, the first visual presentation includes n first visual presentations in one-to-one correspondence with n vertical azimuths, n being a positive integer greater than 1;

[00240] the display module 1901 is configured to display a first sound indicator having an i^{th} first visual presentation based on the first azimuth scale in the compass information, where the i^{th} first visual presentation indicates an i^{th} vertical azimuth corresponding to the first sound source, and i is a positive integer not greater than n .

[00241] In an optional design according to an embodiment, the vertical azimuth includes: an upper azimuth, a middle azimuth, and a lower azimuth;

[00242] the display module 1901 is configured to display an up-pointing first sound indicator based on the first azimuth scale in the azimuth scale sequence, the first sound indicator indicating that the vertical azimuth of the first sound source is the upper azimuth; or display a horizontally symmetrical first sound indicator based on the first azimuth scale in the azimuth scale sequence, the first sound indicator indicating that the vertical azimuth of the first sound source is the middle azimuth; or display a down-pointing first sound indicator based on the first azimuth scale in the azimuth scale sequence, the first sound indicator indicating that the vertical azimuth of the first sound source is the lower azimuth.

[00243] In an optional design according to an embodiment, the display module 1901 is configured to display a first sound indicator having the vertical azimuth scale based on the first azimuth scale in the azimuth scale sequence, the vertical azimuth indicating a pitch angle of the first sound source relative to the first virtual character; or display a first sound indicator having the arrow based on the first azimuth scale in the azimuth scale sequence, an arrow direction of the arrow indicating the vertical azimuth of the first sound source; or display a first sound indicator having the text prompt based on the first azimuth scale in the azimuth scale sequence, the text prompt indicating the vertical azimuth of the first sound source.

[00244] In an optional design according to an embodiment, the first sound source is configured to produce a first sound, the visual presentation of the first sound indicator further includes another visual presentation, where the first visual presentation is different from the another visual presentation, and the another visual presentation include at least one of the following visual presentations:

[00245] a second visual presentation indicating a sound type of the first sound;

[00246] a third visual presentation indicating a sound volume of the first sound;

[00247] a fourth visual presentation indicating a sound distance of the first sound;

[00248] a fifth visual presentation indicating a frequency of action of the first sound.

[00249] In an optional design according to an embodiment, the apparatus further includes:

[00250] a determination module 1903 configured to determine the visual presentation of the first sound indicator according to a sound parameter of the first sound.

[00251] In an optional design according to an embodiment, the sound parameter includes a sound type, and the determination module 1903 is configured to:

[00252] determine the second visual presentation of the first sound indicator according to the sound type of the first sound.

[00253] In an optional design according to an embodiment, the second visual presentation includes a color of the first sound indicator or an icon pattern of the first sound indicator.

[00254] In an optional design according to an embodiment, the first sound indicator is represented by an acoustic amplitude spectrum, the third visual presentation includes an amplitude of the first acoustic amplitude spectrum, the sound parameter includes a sound volume, and the determination module 1903 is configured to determine the amplitude of the first acoustic amplitude spectrum according to an arriving sound volume of the first sound at the first virtual character.

[00255] In an optional design according to an embodiment, the determination module 1903 is configured to determine the arriving sound volume of the first sound according to an original sound volume of the first sound and an influence parameter, and the influence parameter includes at least one of the following parameters:

[00256] a distance between the first sound source and the first virtual character;

[00257] equipment worn by the first virtual character;

[00258] equipment worn by a second virtual character in a case that the first sound source is the second virtual character; and

[00259] a material of the first sound source or a material in contact with the first sound source.

[00260] In an optional design according to an embodiment, for the same original sound volume, the arriving sound volume in a case that the first virtual character is wearing an earphone is larger than the arriving sound volume determined in a case that the first virtual character is not wearing the earphone; alternatively, for the same original sound volume, the arriving sound volume in a case that the first virtual character is wearing a helmet is smaller than the arriving sound volume in a case that the first virtual character is not wearing the helmet; alternatively, for the same original sound volume, the arriving sound volume in a case that the second virtual character is equipped with a muffler is smaller than the arriving sound volume in a case that the first virtual character is not equipped with the muffler.

[00261] In an optional design according to an embodiment, the fourth visual presentation includes a display-starting time of the first sound indicator, the sound parameter includes a sound propagation speed, and the determination module 1903 is configured to determine the display-starting time of the first sound indicator based on the sound propagation speed between the

first sound source and the first virtual character, the display-starting time being later than a generation time of the first sound.

[00262] In an optional design according to an embodiment, the first sound indicator is represented by an acoustic amplitude spectrum, the fifth visual presentation includes a jitter frequency of the acoustic amplitude spectrum, the sound parameter includes a sound propagation speed, and the determination module 1903 is configured to determine the jitter frequency of the acoustic amplitude spectrum based on a frequency of action of the first sound source when producing the first sound.

[00263] In an optional design according to an embodiment, the visual presentation of the first sound indicator includes at least one of a shape, a pattern, a color, a texture, text, an animation effect, a display-starting time, a display duration, and a fading-out time of the first sound indicator.

[00264] In an optional design according to an embodiment, the azimuth scale sequence in the compass information corresponds to a visible azimuth range of the first virtual character, and the display module 1901 is configured to display, in a that there is a second sound source in the surroundings of the first virtual character and a horizontal azimuth of the second sound source is out of the visible azimuth range, a second sound indicator based on an edge azimuth scale in the azimuth scale sequence closest to the horizontal azimuth of the second sound source, the second sound indicator indicating presence of the second sound source beyond a horizontal azimuth indicated by the edge azimuth scale.

[00265] In an optional design according to an embodiment, the display module 1901 is configured to cancel displaying of the first sound indicator in a case that the first virtual character enters a deaf state.

[00266] In an optional design according to an embodiment, the determination module 1903 is configured to determine, in a case that the first sound source produces at least two sounds and a difference between generation times of the at least two sounds is less than a threshold, a sound with a maximum sound volume among the at least two sounds as the first sound.

[00267] The present application also provides a computer device including a processor and a memory, the memory having stored thereon at least one instruction loaded and executed by the processor to implement the method for prompting for a sound according to the method embodiments described above. It should be noted that the computer device may be a terminal as provided in FIG. 20 below.

[00268] FIG. 20 is a schematic structural diagram of a computer device 2000 according to an exemplary embodiment of the present application. The computer device 2000 may be: a smartphone, a tablet computer, a Moving Picture Experts Group Audio Layer III (MP3) player, a Moving Picture Experts Group Audio Layer IV (MP4) player, a notebook computer, or a desktop computer. The computer device 2000 may also be referred to as a user equipment, a portable terminal, a laptop terminal, or a desktop terminal.

[00269] Typically, the computer device 2000 includes: a processor 2001 and a memory 2002.

[00270] The processor 2001 may include one or more processing cores, for example, a 4-core processor or an 8-core processor. The processor 2001 may be implemented in at least one hardware form of a digital signal processor (DSP), a field-programmable gate array (FPGA), and a programmable logic array (PLA). The processor 2001 may also include a main processor and a coprocessor. The main processor is a processor used for processing data in an awake state, and is also referred to as a central processing unit (CPU). The coprocessor is a low power consumption processor used for processing the data in a standby state. In some embodiments, the processor 2001 may be integrated with a graphics processing unit (GPU). The GPU is used for rendering and drawing content that needs to be displayed on a display screen. In some embodiments, the processor 2001 may further include an artificial intelligence (AI) processor. The AI processor is used for processing computing operations related to machine learning.

[00271] The memory 2002 may include one or more computer-readable storage media. The computer-readable storage medium may be non-transient. The memory 2002 may further include a high-speed random access memory and a nonvolatile memory, for example, one or more disk storage devices or flash storage devices. In some embodiments, a non-transitory computer-readable storage medium in memory 2002 is used for storing at least one instruction for execution by processor 2001 to implement the virtual world sound-prompting method provided by the method embodiments of the present application.

[00272] In some embodiments, the computer device 2000 may also optionally include: a peripheral interface 2003 and at least one peripheral. The processor 2001, the memory 2002, and the peripheral interface 2003 may be connected through a bus or a signal cable. Each peripheral may be connected to the peripheral interface 2003 via a bus, a signal cable, or a circuit board. Specifically, the peripheral includes: at least one of a radio frequency circuit 2004, a display screen 2005, a camera 2006, an audio circuit 2007, a positioning component 2008, and a power supply 2009.

[00273] In some embodiments, the computer device 2000 also includes one or more sensors 2010. The one or more sensors 2010 include, but are not limited to: an acceleration sensor 2011, a

gyro sensor 2012, a pressure sensor 2013, a fingerprint sensor 2014, an optical sensor 2015, and a proximity sensor 2016.

[00274] A person skilled in the art may understand that the structure shown in FIG. 20 constitutes no limitation on the computer device 2000, and the terminal may include more or fewer components than those shown in the figure, or some components may be combined, or a different component deployment may be used.

[00275] According to an aspect of the present application, a computer-readable storage medium is further provided, which stores at least one program code loaded and executed by a processor to implement the method for prompting for a sound in a virtual world as described above.

[00276] According to another aspect of the present application, a computer program product or computer program including computer instructions stored in a computer readable storage medium is further provided. A processor of a computer device reads the computer instructions from the computer-readable storage medium, and executes the computer instructions to cause the computer device to perform the method for prompting for a sound in a virtual world as described above.

[00277] It should be understood that “plurality of” in the specification means two or more, and “and/or” describes an association relationship for describing associated objects and represents that three relationships may exist. For example, A/B may represent the following cases: only A exists, both A and B exist, and only B exists. The character “/” in this specification generally indicates an “or” relationship between the associated objects.

[00278] A person of ordinary skill in the art may understand that all or some of the steps of the foregoing embodiments may be implemented by hardware, or may be implemented by a program instructing relevant hardware. The program may be stored in a computer-readable storage medium. The storage medium may be a read-only memory, a magnetic disk, an optical disc, or the like.

[00279] The foregoing descriptions are merely optional embodiments of the present application, but are not intended to limit the present application. Any modification, equivalent replacement, or improvement and the like made within the spirit and principle of the present application shall fall within the protection scope of the present application.

CLAIMS

What is claimed is:

1. A method for prompting for a sound in a virtual world, the method performed by a terminal and comprising:

displaying a perspective screen of a first virtual character, wherein compass information is displayed on the perspective screen and comprises an azimuth scale sequence, and an azimuth scale in the azimuth scale sequence indicates a horizontal azimuth that the first virtual character faces in the virtual world; and

controlling the first virtual character to act in the virtual world; and

displaying a first sound indicator based on a first azimuth scale in the azimuth scale sequence in a case that there is a first sound source in surroundings of the first virtual character during the action of the first virtual character in the virtual world, wherein the first sound indicator indicates a horizontal azimuth and a vertical azimuth corresponding to the first sound source.

2. The method according to claim 1, wherein the displaying a first sound indicator based on a first azimuth scale in the azimuth scale sequence comprises:

displaying a first sound indicator having a visual presentation based on the first azimuth scale in the azimuth scale sequence, wherein a center of the first sound indicator is aligned with the first azimuth scale, the first azimuth scale indicates a horizontal azimuth of the first sound source, and the visual presentation of the first sound indicator indicates the vertical azimuth of the first sound source.

3. The method according to claim 2, wherein the visual presentation of the first sound indicator comprises a first visual presentation indicating the vertical azimuth of the first sound source, and the first visual presentation comprises at least one of:

a shape of the first sound indicator;

a vertical azimuth scale in the first sound indicator;

an arrow in the first sound indicator; and

a text prompt in the first sound indicator.

4. The method according to claim 3, wherein the vertical azimuth comprises an upper azimuth, a middle azimuth, and a lower azimuth;

the displaying a first sound indicator having a visual presentation based on the first azimuth

scale in the azimuth scale sequence comprises:

displaying an up-pointing first sound indicator based on the first azimuth scale in the azimuth scale sequence, wherein the first sound indicator indicates that the vertical azimuth of the first sound source is the upper azimuth; or

displaying a horizontally symmetrical first sound indicator based on the first azimuth scale in the azimuth scale sequence, wherein the first sound indicator indicates that the vertical azimuth of the first sound source is the middle azimuth; or

displaying a down-pointing first sound indicator based on the first azimuth scale in the azimuth scale sequence, wherein the first sound indicator indicates that the vertical azimuth of the first sound source is the lower azimuth.

5. The method according to claim 3, wherein the displaying a first sound indicator having a visual presentation based on the first azimuth scale in the azimuth scale sequence comprises:

displaying a first sound indicator having the vertical azimuth scale based on the first azimuth scale in the azimuth scale sequence, wherein the vertical azimuth scale indicates a pitch angle of the first sound source relative to the first virtual character; or

displaying a first sound indicator having the arrow based on the first azimuth scale in the azimuth scale sequence, wherein an arrow direction of the arrow indicates the vertical azimuth of the first sound source; or

displaying a first sound indicator having the text prompt based on the first azimuth scale in the azimuth scale sequence, wherein the text prompt indicates the vertical azimuth of the first sound source.

6. The method according to claim 3, wherein the first sound source is configured to produce a first sound, and the visual presentation of the first sound indicator further comprises another visual presentation,

wherein the first visual presentation is different from the another visual presentation, and the another visual presentation comprises at least one of the following visual presentations:

a second visual presentation indicating a sound type of the first sound;

a third visual presentation indicating a sound volume of the first sound;

a fourth visual presentation indicating a sound distance of the first sound;

a fifth visual presentation indicating a frequency of action of the first sound.

7. The method according to claim 6, further comprising:

determining the visual presentation of the first sound indicator according to a sound parameter of the first sound.

8. The method according to claim 7, wherein the sound parameter comprises a sound type, and the determining the visual presentation of the first sound indicator according to a sound parameter of the first sound comprises:

determine the second visual presentation of the first sound indicator according to the sound type of the first sound.

9. The method according to claim 8, wherein the second visual presentation comprises a color of the first sound indicator or an icon pattern of the first sound indicator.

10. The method according to claim 7, wherein the first sound indicator is represented by an acoustic amplitude spectrum, the third visual presentation comprises an amplitude of the first acoustic amplitude spectrum, the sound parameter comprises a sound volume, and the determining the visual presentation of the first sound indicator according to a sound parameter of the first sound comprises:

determining the amplitude of the first acoustic amplitude spectrum according to an arriving sound volume of the first sound at the first virtual character.

11. The method according to claim 10, further comprising:

determining the arriving sound volume of the first sound according to an original sound volume of the first sound and an influence parameter,

wherein the influence parameter comprises at least one of the following parameters:

a distance between the first sound source and the first virtual character;

equipment worn by the first virtual character;

equipment worn by a second virtual character in a case that the first sound source is the second virtual character; and

a material of the first sound source or a material in contact with the first sound source.

12. The method according to claim 11, wherein for the same original sound volume, the arriving sound volume in a case that the first virtual character is wearing an earphone is larger than the arriving sound volume in a case that the first virtual character is not wearing the earphone; or

for the same original sound volume, the arriving sound volume in a case that the first virtual

character is wearing a helmet is smaller than the arriving sound volume in a case that the first virtual character is not wearing the helmet; or

for the same original sound volume, the arriving sound volume in a case that the second virtual character is equipped with a muffler is smaller than the arriving sound volume in a case that the first virtual character is not equipped with the muffler.

13. The method according to claim 7, wherein the fourth visual presentation comprises a display-starting time of the first sound indicator, the sound parameter comprises a sound propagation speed, and the determining the visual presentation of the first sound indicator according to a sound parameter of the first sound comprises:

determining the display-starting time of the first sound indicator based on a sound propagation speed between the first sound source and the first virtual character, wherein the display-starting time is later than a generation time of the first sound.

14. The method according to claim 7, wherein the first sound indicator is represented by an acoustic amplitude spectrum, the fifth visual presentation comprises a jitter frequency of the acoustic amplitude spectrum, the sound parameter comprises a frequency of action of the first sound source, and the determining the visual presentation of the first sound indicator according to a sound parameter of the first sound comprises:

determining the jitter frequency of the acoustic amplitude spectrum according to the frequency of action of the first sound source when producing the first sound.

15. The method according to any one of claims 1 to 14, wherein the visual presentation of the first sound indicator comprises at least one of a shape, a pattern, a color, a texture, text, an animation effect, a display-starting time, a display duration, and a fading-out time of the first sound indicator.

16. The method according to any one of claims 1 to 14, wherein the azimuth scale sequence in the compass information corresponds to a visible azimuth range of the first virtual character, and the method further comprises:

displaying, in a that there is a second sound source in the surroundings of the first virtual character and a horizontal azimuth of the second sound source is out of the visible azimuth range, a second sound indicator based on an edge azimuth scale in the azimuth scale sequence closest to the horizontal azimuth of the second sound source, wherein the second sound indicator indicates presence of the second sound source beyond a horizontal azimuth indicated by the edge azimuth scale.

17. The method according to any one of claims 1 to 14, further comprising:
canceling displaying of the first sound indicator in a case that the first virtual character enters a deaf state.
18. The method according to any one of claims 1 to 14, further comprising:
determining, in a case that the first sound source produces at least two sounds and a difference between generation times of the at least two sounds is less than a threshold, a sound with a maximum sound volume among the at least two sounds as a first sound.
19. An apparatus for prompting for a sound in a virtual world, the apparatus deployed on a terminal and comprising:
a display module, configured to display a perspective screen of a first virtual character, wherein compass information is displayed on the perspective screen, the compass information comprising an azimuth scale sequence, and an azimuth scale in the azimuth scale sequence indicates a horizontal azimuth that the first virtual character faces in the virtual world; and
a control module, configured to control the first virtual character to act in the virtual world, wherein the display module is further configured to display a first sound indicator based on a first azimuth scale in the azimuth scale sequence in a case that there is a first sound source in surroundings of the first virtual character during the action of the first virtual character in the virtual world, wherein the first sound indicator indicates a horizontal azimuth and a vertical azimuth corresponding to the first sound source.
20. A computer device, comprising: a processor and a memory having stored thereon at least one program loaded and executed by the processor to implement the method for prompting for a sound in a virtual world according to any one of claims 1 to 18.
21. A computer-readable storage medium having stored thereon at least one program loaded and executed by a processor to implement the method for prompting for a sound in a virtual world according to any one of claims 1 to 18.
22. A computer program product, the computer program product, when executed, causing a processor to implement the method for prompting for a sound in a virtual world according to any one of claims 1 to 18.