

TITLE OF THE INVENTION

IMAGE DISPLAY SYSTEM, METHOD FOR CONTROLLING IMAGE DISPLAY SYSTEM, IMAGE DISTRIBUTION SYSTEM AND HEAD-MOUNTED DISPLAY

FIELD OF THE INVENTION

[0001] The present invention relates generally to an image display system, a method for controlling the image display system, an image distribution system and a head-mounted display.

BACKGROUND ART

[0002] Conventionally, a head-mounted display (HMD) is known as a device which can integrate virtual-world video information into real-world video information in real time (for example, see patent document 1). However, although the head-mounted display of the patent document 1 can display the virtual-world video information, the head-mounted display of the patent document 1 cannot change this video information according to movement (in particular, movement of a hand or a leg) of a wearer wearing the head-mounted display or the like. Thus, it is difficult to improve an immersion feeling (presence feeling) of the wearer.

RELATED ART

PATENT DOCUMENT

[0003] Patent document 1: JP 2015-226110A

SUMMARY OF THE INVENTION

[0004] There is provided an image display system and a method for controlling the image display system which can control video information displayed on a head-mounted display according to a position and movement of a wearer.

[0005] Aspects of the invention are defined in the independent claims. Some optional features of the invention are defined in the dependent claims.

[0006] In one disclosed arrangement, there is an image display system, comprising:

a head-mounted display having a capturing part for capturing a real world and an image display part for displaying video information obtained by integrating real-world video information captured by the capturing part with virtual-world video information;

a movement information detecting part for detecting movement of a body of a wearer wearing the head-mounted display as movement information; and

a position information detecting part for detecting position information of the wearer,

wherein the image display system controls the virtual-world video information based on the movement information and the position information.

[0007] The position information detecting part can obtain the position information of the wearer by performing image recognition of a marker arranged in a space with using the capturing part.

[0008] The position information detecting part can obtain three-dimensional position information of the wearer.

[0009] The movement information detecting part may have a motion sensor to be worn by the wearer.

[0010] The motion sensor may be worn on an arm of the wearer.

[0011] The head-mounted display may have a mobile terminal including the capturing part and the image display part and a frame which is worn on a head of the wearer and to which the mobile terminal may be detachably attached.

[0012] The image display system may further comprise:
 a capturing device for capturing an area in which the wearer exists, and

 an image display device for displaying an image obtained by integrating real-world video information captured by the capturing device with video information obtained by viewing the virtual-world video information displayed on the head-mounted display from a viewpoint of the capturing device.

[0013] (8) There is also disclosed a method for controlling an image display system, the image display system containing a head-mounted display having a capturing part for capturing a real world and an image display part for displaying video information obtained by integrating real-world video information captured by the capturing part with virtual-world video information, a movement information detecting part for detecting movement of a body of a wearer wearing the head-mounted display as movement information and a position information detecting part for detecting position information of the wearer, the method comprising:

 controlling the virtual-world video information based on the movement information and the position information.

[0014] The image display system may further have:

- a capturing device for capturing an area in which the wearer exists, and

- an image display device for displaying video information, and

- wherein the image display system allows the image display device to display an image obtained by integrating real-world video information captured by the capturing device with video information obtained by viewing the virtual-world video information displayed on the head-mounted display from a viewpoint of the capturing device.

[0015] There is also disclosed an image distribution system, comprising:

- a head-mounted display having a capturing part for capturing a real world and an image display part for displaying video information obtained by integrating real-world video information captured by the capturing part with virtual-world video information;

- a movement information detecting part for detecting movement of a body of a wearer wearing the head-mounted display as movement information;

- a position information detecting part for detecting position information of the wearer; and

- a capturing device for capturing an area in which the wearer exists,

- wherein the image distribution system is configured to control the virtual-world video information based on the movement information and the position information, and

- wherein the image distribution system distributes image information obtained by integrating real-world video information captured by the capturing device with video information obtained by viewing the virtual-world video information displayed on the head-mounted display from a viewpoint of the capturing device.

[0016] There is also disclosed a head-mounted display, comprising:

a mobile terminal including an image display part;
and

a frame for detachably supporting the mobile terminal,
wherein the frame has:

a support portion for detachably supporting the mobile terminal at a position in front of eyes of a wearer with a posture in which the image display part is directed toward the side of the eyes of the wearer in a wearing-state that the head-mounted display is worn by the wearer,
and

window portions through which the wearer can see a real world,

wherein the window portions are respectively arranged on at least the side of feet of the wearer in a space positioned between the eyes of the wearer and the mobile terminal attached to the support portion and a lateral side of the wearer in the space in the wearing-state.

EFFECTS

[0017] Since the virtual-world video information displayed on the head-mounted display can be controlled according to the position and the movement of the wearer, it may be possible to improve convenience. Further, it is also possible to distribute a virtual video that the wearer is experiencing as a video viewed from a third party and thus the third part can also experience the virtual video together. Furthermore, it is also possible to provide the head-mounted display which can provide high safety.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] [Fig. 1] Fig. 1 is a configuration diagram showing a first embodiment of a game system to which an image display system and a method for controlling the image

display system are applied.

[Fig. 2] Fig. 2 is a view showing one example of an AR viewing field displayed on a head-mounted display.

[Fig. 3] Fig. 3 is a view showing another example of the AR viewing field displayed on the head-mounted display.

[Fig. 4] Fig. 4 is a view showing modified examples of an arrangement of a marker.

[Fig. 5] Fig. 5 is a perspective view showing the head-mounted display.

[Fig. 6] Fig. 6 is a view showing one example of an image displayed on a screen of a mobile terminal of the head-mounted display.

[Fig. 7] Fig. 7 is a block diagram of the game system shown in Fig. 1.

[Fig. 8] Fig. 8 is a configuration diagram showing a second embodiment of the game system to which the image display system and the method for controlling the image display system are applied.

[Fig. 9] Fig. 9 is a block diagram of the game system shown in Fig. 8.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Hereinafter, detailed description will be given to an image display system and a method for controlling the image display system based on the preferred embodiments shown in the accompanying drawings.

[0020] <First embodiment>

First, description will be given to an image display system and a method for controlling the image display system according to a first exemplary embodiment .

[0021] <First embodiment>

Fig. 1 is a configuration diagram showing a first embodiment of a game system to which the image display

system and the method for controlling the image display system as disclosed herein are applied. Each of Figs. 2 and 3 is a view showing one example of an AR viewing field displayed on a head-mounted display. Fig. 4 is a view showing modified examples of an arrangement of a marker. Fig. 5 is a perspective view showing the head-mounted display. Fig. 6 is a view showing one example of an image displayed on a screen of a mobile terminal of the head-mounted display. Fig. 7 is a block diagram of the game system shown in Fig. 1. In this regard, for the purpose of illustration, a graphical representation for a real world is omitted in each of Figs. 2, 3 and 6.

[0022] As shown in Fig. 1, a game system 100 to which the image display system and the method for controlling the image display system as disclosed herein are applied mainly has a marker 200 arranged in a field F, a head-mounted display 300 and a motion sensor (a movement information detecting part) 400 which are worn by a player (a wearer) P, a camera (a capturing device) 500 for capturing the player P, a display (an image display device) 600 for displaying a video captured by the camera 500 and a server 700.

[0023] In the game system 100 as described above, a video obtained by integrating real-world video information with virtual-world video information is displayed on the head-mounted display 300 and the virtual-world video information is changed according to a position (position information) and movement (movement information) of the player P. Namely, the game system 100 is configured to control the virtual-world video information based on the position and the movement of the player P. Thus, according to the game system 100, it is possible to provide the player P with a body-sensitive AR (Augmented Reality).

displayed on the display 600 in this embodiment.

[0056] Further, the display 600 is not particularly limited as long as it can display an image. For example, the display 600 may take a configuration in which an image is projected on a screen or a wall surface by a projector. Further, a mobile terminal (a smartphone, a tablet terminal and the like) of each gallery may be used as the display 600. In this case, the video is distributed to the mobile terminal of each gallery from the server 700.

[0057] Up to here, the game system 100 has been described. In this regard, although the case where one player P plays the game has been described in this embodiment, the number of players P is not particularly limited to one. The number of the players P may be two or more and the two or more players P may battle with the monster M in cooperation with each other. In this case, the head-mounted display 300 (the mobile terminal 310) worn by each player P is configured to receive various information (the position information, the movement information and the like) of other players P. In addition to the monster M and the commands self-selected by each player P, the commands selected by the other players P are also displayed on the head-mounted display 300 worn by each player P as the video.

[0058] <Second embodiment>

Next, description will be given to an image display system and a method for controlling the image display system according to a second exemplary embodiment.

[0059] <Second embodiment>

Fig. 8 is a configuration diagram showing the second embodiment of the game system to which the image display

system and the method for controlling the image display are applied. Fig. 9 is a block diagram of the game system shown in Fig. 8.

[0060] <Second embodiment>

Hereinafter, the image display system and the method for controlling the image display system according to the second embodiment will be described by placing emphasis on the points differing from the above-described embodiment, with the same matters being omitted from the description.

[0061] The image display system and the method for controlling the image display system according to the second embodiment have the same configurations as those of the above-described first embodiment except that the game contents are modified. In this regard, the same reference numbers are added to the same components as those of the above-described embodiment.

[0062] As shown in Figs. 8 and 9, the game system 100 of this embodiment mainly has a pair of markers 200A, 200B arranged in the field F, a head-mounted display 300A and a motion sensor 400A worn by a first player P1, a head-mounted display 300B and a motion sensor 400B worn by a second player P2, the camera 500 for capturing the first player P1 and the second player P2, the display 600 for displaying the video captured by the camera 500 and the server 700.

[0063] A game performed by using the game system 100 of this embodiment is a battle-type game in which the first player P1 and the second player P2 battle with each other. The first player P1 and the second player P2 are positioned so as to face each other and each player P1, P2 moves his/her body to attack the opponent player or defend

[0068] Each of the head-mounted displays 300A, 300B as described above has the same configuration as the head-mounted display explained in the above-described first embodiment.

[0069] Up to here, the second embodiment has been described. Although the one-to-one battle-type game system 100 has been described in this embodiment, the number of the players is not particularly limited. The battle style of the game system 100 may be a many-to-many style such as a two-to-two style, a three-to-three style.

[0070] Up to here, although the image display system, the method for controlling the image display system, the image distribution system and the head-mounted display of have been described based on the embodiments illustrated in the drawings, the present invention is not limited thereto. The configuration of each component can be replaced with an arbitrary configuration having the same function. Further, other arbitrary components may be added to the present invention. Further, the embodiments may be appropriately combined with each other.

[0071] Further, although the configuration in which the image display system, the method for controlling the image display system, the image distribution system and the head-mounted display are applied to the game system has been described in the above-described embodiments, the field to which the image display system and the method for controlling the image display system are applied is not limited to the game field. For example, the image display system and the method for controlling the image display system may be applied to a design simulation for home electronics, a car, an airplane and the like.

INDUSTRIAL APPLICABILITY

[0072] The game system 100 to which the image display system is applied contains the head-mounted display 300 having the camera for capturing the real-world and the display for displaying the video information obtained by integrating the real-world video information captured by this camera with the virtual-world video information, the motion sensor 400 for detecting the movement of the body of the wearer wearing the head-mounted display 300 as the movement information and the marker 200 used for detecting the position information of the wearer. The game system 100 controls the virtual-world video information based on the movement information and the position information. According to this configuration, it is possible to control the video information displayed on the head-mounted display according to the position and the movement of the wearer. For the reason stated above, the present invention has industrial applicability.

DESCRIPTION OF REFERENCE SIGNS

[0073] 100... Game system; 200, 200A, 200B... Marker; 300, 300A, 300B... Head-mounted display; 310... Mobile terminal; 311... Screen; 311L, 311R... Image area; 312... Camera; 313... Movement determining part; 314... Position determining part; 315... Video information creating part; 320... Frame; 330... Frame main body; 331... Front portion; 332... Upper portion; 333... Lower portion; 333a... Plate member; 334, 335... Lateral portion; 334a, 335a... Aperture; 336... Lens portion; 336L, 336R... Lens; 337... Shock-absorbing portion; 340... Band; 350... Slot portion; 351... Slot port; 352... Window portion; 360... Lock mechanism; 361... Lock plate; 361a... Groove; 362... Screw; 400, 400A, 400B... Motion sensor; 410... Acceleration sensor; 420... Angular velocity sensor; 500... Camera; 600... Display; 700... Server; F... Field; M... Monster;

What is claimed is:

1. An image display system, comprising:

 a head-mounted display having a capturing part for capturing a real world and an image display part for displaying video information obtained by integrating real-world video information captured by the capturing part with virtual-world video information;

 a movement information detecting part for detecting movement of a body of a wearer wearing the head-mounted display as movement information; and

 a position information detecting part for detecting position information of the wearer,

 wherein the image display system is configured to control the virtual-world video information based on the movement information and the position information, and

 wherein the position information detecting part is configured to obtain the position information of the wearer by performing image recognition of a marker arranged in a space with using the capturing part, to allow a virtual object corresponding to the wearer to follow the wearer based on the obtained position information and to use the virtual object to perform determination for collision with the wearer.

2. The image display system as claimed in claim 1, wherein the position information detecting part can obtain three-dimensional position information of the wearer.

3. The image display system as claimed in claim 1 or 2, wherein the movement information detecting part has a motion sensor to be worn by the wearer.

4. The image display system as claimed in claim 3, wherein the motion sensor is configured to be worn on an arm of the wearer.

5. The image display system as claimed in any one of claims 1 to 4, wherein the head-mounted display has a mobile

terminal including the capturing part and the image display part and a frame for wearing on a head of the wearer and wherein the frame is configured to be detachably attached to the mobile terminal.

6. The image display system as claimed in any one of claims 1 to 5, further comprising:

a capturing device for capturing an area in which the wearer exists, and

an image display device for displaying an image obtained by integrating real-world video information captured by the capturing device with video information obtained by viewing the virtual-world video information displayed on the head-mounted display from a viewpoint of the capturing device.

7. A method for controlling an image display system, the image display system containing a head-mounted display having a capturing part for capturing a real world and an image display part for displaying video information obtained by integrating real-world video information captured by the capturing part with virtual-world video information, a movement information detecting part for detecting movement of a body of a wearer wearing the head-mounted display as movement information and a position information detecting part for detecting position information of the wearer, and the image display system configured to control the virtual-world video information based on the movement information and the position information, the method characterized in that:

the position information detecting part obtains the position information of the wearer by performing image recognition of a marker arranged in a space with using the capturing part, allows a virtual object corresponding to the wearer to follow the wearer based on the obtained position information and uses the virtual object to perform determination for collision with the wearer.

8. The method for controlling the image display system as claimed in claim 7, wherein the image display system further has:

- a capturing device for capturing an area in which the wearer exists, and

- an image display device for displaying video information, and

- wherein the image display system allows the image display device to display an image obtained by integrating real-world video information captured by the capturing device with video information obtained by viewing the virtual-world video information displayed on the head-mounted display from a viewpoint of the capturing device.

9. An image distribution system using an image display system, the image display system containing:

- a head-mounted display having a capturing part for capturing a real world and an image display part for displaying video information obtained by integrating real-world video information captured by the capturing part with virtual-world video information;

- a movement information detecting part for detecting movement of a body of a wearer wearing the head-mounted display as movement information;

- a position information detecting part for detecting position information of the wearer; and

- a capturing device for capturing an area in which the wearer exists, and

- the image display system is configured to control the virtual-world video information based on the movement information and the position information, the image distribution system characterized in that:

- the position information detecting part is configured to obtain the position information of the wearer by performing image recognition of a marker arranged in a space with using the capturing part, to allow a virtual object corresponding to the wearer to follow the wearer based on the obtained position information and to use the

virtual object to perform determination for collision with the wearer, and

the image distribution system is configured to distribute image information obtained by integrating real-world video information captured by the capturing device with video information obtained by viewing the virtual-world video information displayed on the head-mounted display from a viewpoint of the capturing device.