

Description

[Title of Invention] INFORMATION PROCESSING APPARATUS AND
INFORMATION PROCESSING METHOD

[Technical Field]

[0001]

The present disclosure relates to an information processing apparatus and an information processing method for setting a waypoint of a mobile body.

[Background Art]

[0002]

Various services involving unmanned aerial vehicles, such as drones and unmanned aircraft, have recently been provided.

[0003]

These aerial vehicles may be used for purposes such as aerial photography, inspection, and survey, for example. For an aerial vehicle to autonomously fly for such a purpose and perform predetermined processing at predetermined locations, waypoints of the aerial vehicle are set. For example, Patent Literature 1 below discloses a technique for setting a flight route with respect to three-dimensional geographic information.

[Citation List]

[Patent Literature]

[0004]

[Patent Literature 1] International Publication No. WO
2019/077682

[Summary of Invention]

[Technical Problem]

[0005]

Shooting images of or inspecting a real object such as a building by a mobile body such as an aerial vehicle requires relatively accurate positioning of waypoints of the mobile body. With the technique disclosed in Patent Literature 1 above, the waypoints need to be determined from a macroscopic bird's-eye viewpoint. From the perspective of accuracy and operability, this imposes a heavy load on the user in setting the waypoints.

[0006]

The present invention has been made in view of the above background, and an object thereof is to provide an information processing apparatus and an information processing method that enable more accurately and readily setting a waypoint of a mobile body.

[0007]

According to the present disclosure, an information processing apparatus for setting a waypoint of a mobile body is provided. The apparatus includes: a display

control unit that causes a display device to display view images of a virtual three-dimensional space corresponding to a space for movement; a determination unit that determines a selected view image of the view images displayed; and a point setting unit that sets the waypoint of the mobile body in the space for movement based on a viewpoint position of the selected view image.

[0008]

According to the present disclosure, an information processing method for setting a waypoint of a mobile body is provided. The method includes: causing a display device to display view images of a virtual three-dimensional space corresponding to a space for movement; determining a selected view image of the view images displayed; and setting the waypoint of the mobile body in the space for movement based on a viewpoint position of the selected view image.

[Advantageous Effect of Invention]

[0009]

The present disclosure enables more accurately and readily setting a waypoint of a mobile body.

[Brief Description of Drawings]

[0010]

[Figure 1] Figure 1 is a diagram for describing an overview of a route setting system for aerial vehicles.

[Figure 2] Figure 2 is a diagram showing an overview of a system according to an embodiment of the present disclosure.

[Figure 3] Figure 3 is a diagram showing the hardware configuration of an information processing apparatus according to the embodiment.

[Figure 4] Figure 4 is a functional block diagram of an aerial vehicle according to the embodiment.

[Figure 5] Figure 5 is a block diagram showing functions of a control unit 11 in the information processing apparatus according to the embodiment.

[Figure 6] Figure 6 is a diagram showing an example of processing in a virtual three-dimensional space.

[Figure 7] Figure 7 is a diagram showing an example of display on a display device presented by a display control unit according to the embodiment.

[Figure 8] Figure 8 is a diagram showing an example of the processing of setting a waypoint by a point setting unit according to the embodiment.

[Figure 9] Figure 9 is a flowchart of control in the information processing apparatus according to the embodiment.

[Description of Embodiment]

[0011]

With reference to the accompanying drawings, a preferred embodiment of the present disclosure will be described in detail below. Throughout this specification

and the drawings, elements having substantially like functional configurations are labeled with like symbols and not repeatedly described.

[0012]

Details of an embodiment of the present disclosure will be described as listed below. The technique according to the embodiment of the present disclosure includes the following aspects.

(Item 1)

An information processing apparatus for setting a waypoint of a mobile body, the apparatus including:

a display control unit that causes a display device to display view images of a virtual three-dimensional space corresponding to a space for movement;

a determination unit that determines a selected view image of the view images displayed; and

a point setting unit that sets the waypoint of the mobile body in the space for movement based on a viewpoint position of the selected view image.

(Item 2)

The information processing apparatus according to Item 1, wherein the point setting unit sets the waypoint of the mobile body at a position in the space for movement corresponding to the viewpoint position of the selected view image.

(Item 3)

The information processing apparatus according to Item 1 or 2, wherein the point setting unit sets a direction of the mobile body at the waypoint of the mobile body based on a line-of-sight direction at the viewpoint position of the selected view image.

(Item 4)

The information processing apparatus according to any one of Items 1 to 3, wherein

the mobile body includes a camera, and

the point setting unit sets a direction of an optical axis of the camera based on a line-of-sight direction at the viewpoint position of the selected view image.

(Item 5)

The information processing apparatus according to any one of Items 1 to 4, wherein

the mobile body includes a camera, and

the point setting unit sets the waypoint at a position in the space for movement at which the camera can generate a shot image corresponding to the selected view image.

(Item 6)

The information processing apparatus according to any one of Items 1 to 5, wherein the display control unit performs control for displaying the view images on a stereoscopic device.

(Item 7)

The information processing apparatus according to any one of Items 1 to 6, wherein the display control unit causes a position corresponding to a viewpoint position of each view image to be displayed on a screen associated with map information corresponding to the space for movement.

(Item 8)

The information processing apparatus according to any one of Items 1 to 7, wherein information on the virtual three-dimensional space is generated based on geographic information provided from an external server.

(Item 9)

An information processing method for setting a waypoint of a mobile body, the method including:

causing a display device to display view images of a virtual three-dimensional space corresponding to a space for movement;

determining a selected view image of the view images displayed; and

setting the waypoint of the mobile body in the space for movement based on a viewpoint position of the selected view image.

[0013]

A route setting system for aerial vehicles according to an embodiment of the present disclosure will be described below with reference to the drawings. Figure 1 is a diagram for describing an overview of a route setting system for aerial vehicles.

[0014]

The example shown in Figure 1 illustrates waypoints 1001 and a flight route 1002 of an aerial vehicle that are visualized in a virtual three-dimensional space 1000. The virtual three-dimensional space 1000 is a space generated based on virtual three-dimensional spatial data corresponding to an actual space for flight (an example of a space for movement).

[0015]

The virtual three-dimensional space 1000 may be based on geographical information provided by an external server, for example, spatial data available from Google Maps (R), Google Earth (R), or the Geospatial Information Authority of Japan. Such three-dimensional spatial data may include object information such as an architectural object 1010. The architectural object 1010 may be information additionally included in the geographic information. The architectural object information in the geographic information may be omitted in the virtual three-dimensional space 1000. This allows representing, for

example, the space for flight before and after a building is constructed.

[0016]

As shown in Figure 1, the waypoints 1001 are set in the virtual three-dimensional space 1000, and the flight route 1002 is set to connect the waypoints 1001. Each waypoint 1001 may have settings, for example, the direction (including directions before and after veering) and attitude of the aerial vehicle, and the direction of a camera provided on the aerial vehicle. These settings enable, for example, setting an appropriate flight heading at the waypoint 1001 and specifying the direction of image shooting at the waypoint 1001.

[0017]

In an embodiment of the present disclosure, the above settings, such as the direction or attitude of the aerial vehicle or the camera, are determined using a view image of the virtual three-dimensional space 1000. Determining the settings with reference to the view image enables more appropriately determining the direction or attitude of the aerial vehicle or the camera desired by the operator or manager of the aerial vehicle. The following describes a system according to an embodiment of the present disclosure.

[0018]

Figure 2 is a diagram showing an overview of a system 1 according to the embodiment. As shown in Figure 2, the system 1 includes an information processing apparatus 10

and a display device 20 (21). The system 1 can send flight route information to an aerial vehicle 30. The system 1 can also receive geographic information from an external server 40.

[0019]

The information processing apparatus 10 is configured to be able to connect to the display device 20 over a network such as the Internet. Examples of the network include a local area network (LAN), a wide area network (WAN), an infrared network, a radio network, a WiFi network, a point-to-point (P2P) network, a telecommunication network, and a cloud communication network.

[0020]

The display device 20 may be a display, a television, a screen, or a monitor. The display device 20 has the function of displaying information received from the information processing apparatus 10. The display device 20 may include input devices, such as a mouse, a keyboard, switches, buttons, sensors, a microphone, and a touch panel. Information obtained through inputs to the input devices may be sent from the display device 20 to the information processing apparatus 10.

[0021]

The display device may also be VR goggles 21. The VR goggles 21 are an example of a display device for stereoscopically representing a virtual three-dimensional space corresponding to a space for flight and presenting

the stereoscopic representation to a user. Using the VR goggles 21 allows enhancing the realism of a virtual three-dimensional space and more precisely setting information on waypoints of an aerial vehicle. The display device is not limited to the VR goggles 21 but may be any stereoscopic display device.

[0022]

The aerial vehicle 30 is an example of a mobile body. Although Figure 2 shows an unmanned aerial vehicle as an example of the mobile body, the mobile body may take any form, for example, an automobile, a watercraft, or a submersible, that operates autonomously according to control signals. Examples of the aerial vehicle 30 include unmanned aerial vehicles (e.g., drones and multicopters) that autonomously fly based on control information obtained in advance from a control apparatus such as the information processing apparatus 10. The aerial vehicle may be of any type. The aerial vehicle 30 autonomously flies based on information on a flight route and waypoints received from the information processing apparatus 10. The aerial vehicle 30 may be interconnected with the information processing apparatus 10 through connection based on, for example, LTE, 5G, infrared, WiFi, Bluetooth (R), Bluetooth Low Energy (BLE), or wired connection.

[0023]

The external server 40, composed of one or more servers (e.g., cloud servers), has geographic information. The geographic information may include, for example, map information and topographic information, as well as their associated information, including additional information and meta information. For example, the additional information may be information on buildings. The geographic information may be provided by a geographic information system (GIS). The information processing apparatus 10 may obtain the geographic information from the external server 40 through an application programming interface (API). If the information processing apparatus 10 has the geographic information stored in advance, for example, in a storage 13, the information processing apparatus 10 does not need to obtain the geographic information from the external server 40.

[0024]

As an example, assume that the flight route of the aerial vehicle 30 is set and the aerial vehicle 30 performs a predetermined operation at a waypoint (an intermediate point in the flight route at which the aerial vehicle 30 is to perform an operation, such as image shooting or inspection). To cause the aerial vehicle 30 to appropriately perform the operation, a predetermined direction or attitude to be taken by the aerial vehicle 30 may be set with respect to a target object or a target

space. The direction or attitude of the aerial vehicle 30 could be set as a numerical value; however, whether the aerial vehicle 30 takes the desired direction in the actual space for flight would not be known until the aerial vehicle 30 actually flies.

[0025]

To address this, the system 1 according to the embodiment builds the virtual three-dimensional space 1000 corresponding to the space for flight and obtains view images viewed from viewpoints of a virtual aerial vehicle (or a camera provided on the aerial vehicle) in the virtual three-dimensional space 1000. Of the view images, a view image reflecting a desired view is selected to be a selected view image. The viewpoint position of the selected view image is used to set a waypoint of the aerial vehicle. This enables a user that flies the aerial vehicle 30 to more intuitively recognize the waypoint of the aerial vehicle 30, that is, to more accurately set the waypoint of the aerial vehicle 30.

[0026]

Components of the system 1 according to the embodiment will be described below.

[0027]

Figure 3 is a diagram showing the hardware configuration of the information processing apparatus 10 according to the embodiment. The configuration shown is

merely an example, and the apparatus may have other configurations.

[0028]

As shown, the information processing apparatus 10, connected to a database (not shown), constitutes part of the system. The information processing apparatus 10 may be a general-purpose computer such as a workstation or a personal computer, or may be logically implemented by cloud computing.

[0029]

The information processing apparatus 10 includes at least a control unit 11, a memory 12, a storage 13, a communication unit 14, and an I/O unit 15, which are electrically interconnected via a bus 16.

[0030]

The control unit 11 is an operational device that controls the general operation of the information processing apparatus 10 to control data exchange between components and to perform information processing required for executing applications and for authentication. For example, the control unit 11 may be a central processing unit (CPU), which loads programs stored in the storage 13 into the memory 12 and performs relevant information processing.

[0031]

The memory 12 includes main memory that consists of volatile memory such as dynamic random-access memory (DRAM), and auxiliary memory that consists of nonvolatile memory such as flash memory or a hard disk drive (HDD). The memory 12 is used as a work area for the control unit 11 and also stores items, such as a basic input/output system (BIOS) executed upon startup of the information processing apparatus 10 and various types of setting information.

[0032]

The storage 13 stores various programs such as application programs. A database that stores data used for relevant processing may be built in the storage 13.

[0033]

The communication unit 14 connects the information processing apparatus 10 to a network and/or a block chain network. The communication unit 14 may include a short-range communication interface for Bluetooth (R) and Bluetooth Low Energy (BLE).

[0034]

The I/O unit 15 includes information input devices such as a keyboard and a mouse, and output devices such as a display.

[0035]

The bus 16 is connected to each of the above components to communicate, for example, address signals, data signals, and various control signals.

[0036]

Figure 4 is a functional block diagram of the aerial vehicle 30 according to the embodiment. For simplicity, the functional block diagram to be described below illustrates the concept of functions housed in a single device (in Figure 4, an aerial vehicle). Alternatively, for example, some of the functions may be carried out by an external device (e.g., the information processing apparatus 10) or may be logically implemented using a cloud computing technique.

[0037]

A flight controller 31 may include one or more processors such as programmable processors (e.g., central processing units (CPUs)).

[0038]

The flight controller 31 includes and can access a memory 311. The memory 311 stores logic, code, and/or program instructions executable by the flight controller 31 for performing one or more steps.

[0039]

The memory 311 may include a removable medium or an external storage device, for example, an SD card or random-access memory (RAM). Data obtained from external devices

35 such as a camera 351 and sensors 352 may be directly communicated to the memory 311 and stored therein. For example, still images and videos shot by the camera may be recorded in internal memory or external memory. The external devices 35 are fixed to the aerial vehicle via a gimbal 34.

[0040]

The flight controller 31 includes a control unit 312 configured to control the state of the aerial vehicle. For example, to adjust the spatial disposition, speed, and/or acceleration of the aerial vehicle having six degrees of freedom (translational movements x , y , and z , and rotational movements θ_x , θ_y , and θ_z), the control unit 312 controls propelling mechanisms (such as motors 37) of the aerial vehicle via electric speed controllers (ESCs) 36. The motors 37 rotate propellers 38 to provide lift to the aerial vehicle. The control unit 312 can control one or more of the states of on-board mechanisms and sensors.

[0041]

The flight controller 31 can communicate with a transceiver unit 33 configured to transmit data to and/or receive data from one or more external devices (e.g., a transceiver (a radio controller), a terminal, a display device, or other remote controllers). The transceiver can use any appropriate communication means, such as wired communication or wireless communication.

[0042]

For example, the transceiver unit 33 can use one or more of a local area network (LAN), a wide area network (WAN), infrared communication, radio communication, wired communication, WiFi communication, a point-to-point (P2P) network, a telecommunication network, and cloud communication.

[0043]

The transceiver unit 33 can transmit and/or receive one or more pieces of data obtained by the camera or the sensors, results of processing by the flight controller 31, predetermined control data, and user commands from a terminal or a remote controller. In this embodiment, communication with the information processing apparatus 10 may be via the transceiver unit 33.

[0044]

The sensors 352 (included in the external devices 25) according to the embodiment may include inertial sensors (an accelerometer and a gyro sensor), positioning sensors (a GPS sensor), ranging sensors (e.g., a laser sensor, an ultrasound sensor, and a LiDAR), and geomagnetic sensors. The sensors also include vision/image sensors (e.g., the camera 351).

[0045]

Figure 5 is a block diagram showing functions of the control unit 11 in the information processing apparatus 10 according to the embodiment. The configuration shown in Figure 5 is exemplary and not limiting.

[0046]

The control unit 11 includes an obtention unit 111, a display control unit 112, a determination unit 113, and a point setting unit 114.

[0047]

The obtention unit 111 has the function of obtaining various types of information from inside or outside the control unit 11. For example, the obtention unit 111 obtains geographic information from the external server 40 or the storage 13. The geographic information includes geographic information on a real space for flight corresponding to a virtual three-dimensional space to be described later. The virtual three-dimensional space may be rendered by the control unit 11 when, for example, displayed by the display control unit 112 on a display device.

[0048]

The display control unit 112 has the function of causing a display unit to display view images of the virtual three-dimensional space corresponding to the space for flight. As shown in Figure 1, the virtual three-

dimensional space is a space modeled to correspond to the space for flight in which the aerial vehicle 30 is to fly.
[0049]

Figure 6 is a diagram showing an example of processing in the virtual three-dimensional space. The virtual three-dimensional space 1000 shown in Figure 6 includes the architectural object 1010. A flight route section 1001a of the aerial vehicle, and waypoints 1002a and 1002b of the aerial vehicle, are already set near the architectural object 1010. It is assumed here that another flight route section 1001b originating from the waypoint 1002b is to be set, that is, the next waypoint is to be set.

[0050]

A view image viewed from a viewpoint position 1003 is then obtained in the virtual three-dimensional space 1000. Here, a view image corresponding to a line of sight 1004c at the viewpoint position 1003 is obtained. The viewpoint position 1003 and the line of sight 1004c can be changed as appropriate, for example, through the I/O unit 15. This change allows multiple view images to be obtained. The view images may be still images or videos.

[0051]

The display control unit 112 outputs the obtained view images to the display device 20 or 21.

[0052]

Figure 7 is a diagram showing an example of display on the display device 20 presented by the display control unit 112 according to the embodiment. As shown in Figure 7, a view image Img1 is displayed on the display device 20. The view image Img1 shows part of the virtual three-dimensional space 1000. The view image Img1 has been obtained at the viewpoint position 1003 in Figure 6.

[0053]

The view image Img1 includes the architectural object 1010 and also includes the flight route section 1001a and the waypoint 1002b that have already been set. The view image Img1 is a bird's-eye image of the architectural object 1010 viewed from a diagonal direction.

[0054]

The display control unit 112 may present a screen 1005 associated with map information corresponding to the space for flight, and may cause the screen 1005 to show a position 1006 corresponding to the viewpoint position 1003 of the view image Img1. The screen 1005 may be displayed to be superimposed on the view image Img1. The map information may be two-dimensional map information, or may be map information corresponding to a three-dimensional space obtained based on a view different from the view image Img1. This enables bird's-eye recognition of the viewpoint position 1003.

[0055]

The display control unit 112 may also present information on the viewpoint position 1003 at which the view image Img1 is obtained. In the example shown in Figure 7, viewpoint position information 1007 is shown in the view image Img1. The viewpoint position information 1007 indicates latitude information (Lat.), longitude information (Lon.), horizontal angle information (Dir.), and elevation angle information (Ang.). This enables knowing more accurate information on the viewpoint position.

[0056]

The user who sets the route of the aerial vehicle 30 can change the view image Img1 displayed on the display device 20 as appropriate to determine a desired view image. This operation may be performed through an input device associated with the display device 20, such as a touch panel, or through the I/O unit 15 of the information processing apparatus 10.

[0057]

The determination unit 113 has the function of determining a selected view image of the view images displayed on the display device 20. For example, the view image displayed on the display device 20 may be changed by the user's operation as appropriate. When the user identifies a desired view and performs a determination operation through means such as the I/O unit 15, the

determination unit 113 may determine the view image displayed on the display device 20 at that time to be the selected view image. If multiple view images are selected, the determination unit 113 may determine one of the view images to be the selected view image. If the view image is a video, the determination unit 113 may extract a frame from the video and determine the frame to be the selected view image.

[0058]

The point setting unit 114 has the function of setting a waypoint of the aerial vehicle 30 in the space for flight based on the viewpoint position of the selected view image. For example, the point setting unit 114 may set the waypoint of the aerial vehicle 30 at the viewpoint position.

[0059]

Figure 8 is a diagram showing an example of the processing of setting a waypoint by the point setting unit 114 according to the embodiment. The point setting unit 114 sets a waypoint 1002c. The waypoint 1002c is at a position corresponding to the viewpoint position 1003 shown in Figure 6. That is, the waypoint may be set simply at the position at which the view image Img1 shown in Figure 7 can be obtained. This enables the user to set a desired waypoint more accurately. The point setting unit 114 may also set the waypoint with an offset that reflects factors such as the relationship between the viewpoint

position and the position of the aerial vehicle 30 or the camera 351.

[0060]

The point setting unit 114 may also set the direction of the aerial vehicle 30 or the direction of the optical axis of the camera 351 provided on the aerial vehicle 30 at the waypoint, based on the line-of-sight direction at the viewpoint position of the selected view image. The direction here includes the horizontal direction and the elevation angle. As shown in Figure 8, the directions 1004a, 1004b, and 1004c of the aerial vehicle 30 or of the optical axis of the camera 351 at the waypoints 1002a, 1002b, and 1002c may correspond to the line-of-sight directions at the viewpoint positions corresponding to the respective waypoints. Thus, the direction of the aerial vehicle 30, or the direction of the optical axis of the camera 351, may be set based on the line-of-sight direction at each viewpoint position. This enables more accurately and appropriately setting the direction of the aerial vehicle 30, or the direction of the optical axis of the camera 351, in operations in the space for flight represented by the virtual three-dimensional space 1000.

[0061]

An example of the point setting unit 114 setting the direction of the aerial vehicle 30 based on the line-of-sight direction may be a case where the external devices 35 provided on the aerial vehicle 30, such as the sensors

352 and an actuator, are used to perform operations for a target, such as a building, corresponding to an object in the view image. An example of the point setting unit 114 setting the direction of the optical axis of the camera 351 based on the line-of-sight direction may be a case where the camera 351 is used to shoot images of a target, such as a building, corresponding to an object in the view image.

[0062]

The point setting unit 114 may also set the waypoint at a position in the space for flight at which the camera 351 can generate a shot image corresponding to the selected view image. That is, the point setting unit 114 may set the waypoint at a point at which the camera 351 can be oriented in the direction for generating a shot image corresponding to the selected view image. Such point and direction can be determined from the relationship of relative position and attitude between the aerial vehicle 30 and the camera 351, and the relationship of positional information between the virtual three-dimensional space and the actual space for flight. This, for example, allows an image shot by the camera 351 to more closely match the selected view image.

[0063]

Information on the waypoint set by the point setting unit 114 is output to, for example, the aerial vehicle 30. Based on the waypoint information received, the aerial

vehicle 30 performs processing, related to the flight manner and operations at the waypoint. The waypoint information may also be stored in the storage 13 as appropriate. The waypoint may also be used to set the flight route according to some other program in the control unit 11.

[0064]

Figure 9 is a flowchart of control in the information processing apparatus 10 according to the embodiment. The obtention unit 111 obtains geographic information from, for example, the external server 40 (step SQ101). The display control unit 112 causes the display device 20 to display view images of a virtual three-dimensional space resulting from the geographic information obtained (step SQ103).

[0065]

The determination unit 113 determines a selected view image of the view images based on, for example, the user's operation (step SQ105). The point setting unit 114 sets a waypoint of the aerial vehicle 30 based on the selected view image (step SQ107). The control unit 11 outputs information on the set waypoint to, for example, the aerial vehicle 30 and/or the storage 13 (step SQ109). The waypoint information may be output each time the waypoint is set, or multiple pieces of waypoint information may be collectively output after the control unit 11 sets multiple waypoints.

[0066]

As described above, the system 1 according to the embodiment obtains view images of a virtual three-dimensional space corresponding to a space for flight and sets a waypoint of an aerial vehicle based on a desired one of the view images. Thus, the waypoint (and the direction of the aerial vehicle or a camera) can be set intuitively and more accurately in the space that simulates an environment close to the actual space for flight. This enables more accurately and readily setting the waypoint of the aerial vehicle than conventional manners, leading to a decreased load on the user.

[0067]

While a preferred embodiment of the present disclosure has been described in detail above with reference to the accompanying drawings, the technical scope of the present disclosure is not limited to the above examples. Obviously, those having general knowledge of the technical field of the present disclosure may contemplate variations or modifications within the scope of the technical spirit set forth in the claims. It is therefore to be understood that such variations and modifications are within the technical scope of the present disclosure.

[0068]

The apparatus described herein may be implemented as a single apparatus, or as multiple apparatuses (e.g., cloud servers) networked partially or entirely. For example,

the control unit 11 and the storage 13 of the information processing apparatus 10 may be respectively implemented by separate servers networked with each other.

[0069]

A series of process steps performed by the apparatus described herein may be implemented in any of software, hardware, and a combination thereof. A computer program for implementing the functions of the information processing apparatus 10 according to the embodiment may be created and installed into a device such as a personal computer (PC). A computer-readable recording medium having such a computer program stored therein may also be provided. Examples of the recording medium include a magnetic disk, an optical disc, a magneto-optical disk, and flash memory. The above computer program may also be distributed over a network, for example, rather than on a recording medium.

[0070]

The process described herein with reference to the flowchart does not need to be performed in the order illustrated. Some process steps may be performed in parallel. Additional process steps may be adopted, or some process steps may be eliminated.

[0071]

Advantageous effects described herein are merely illustrative or exemplary, and not limiting. That is, in addition to or in place of the above-described advantageous

effects, the technique according to the present disclosure may have other advantageous effects that are apparent to those skilled in the art from the description herein.

[0072]

The aerial vehicle of the present disclosure will be useful as an industrial aerial vehicle for purposes such as research, survey, and observation. The aerial vehicle of the present disclosure can also be used in industries related to aircraft such as multicopters and drones.

[Reference Signs List]

[0073]

- 1 system
- 10 information processing apparatus
- 20 display device
- 21 VR goggles
- 30 aerial vehicle (example of mobile body)
- 40 external server
- 111 obtention unit
- 112 display control unit
- 113 determination unit
- 114 point setting unit

Claims

[Claim 1]

An information processing apparatus for setting a waypoint of a mobile body, the apparatus comprising:

a display control unit that causes a display device to display view images of a virtual three-dimensional space corresponding to a space for movement;

a determination unit that determines a selected view image of the view images displayed; and

a point setting unit that sets the waypoint of the mobile body in the space for movement based on a viewpoint position of the selected view image.

[Claim 2]

The information processing apparatus according to claim 1, wherein the point setting unit sets the waypoint of the mobile body at a position in the space for movement corresponding to the viewpoint position of the selected view image.

[Claim 3]

The information processing apparatus according to claim 1 or 2, wherein the point setting unit sets a direction of the mobile body at the waypoint of the mobile body based on a line-of-sight direction at the viewpoint position of the selected view image.

[Claim 4]

The information processing apparatus according to any one of claims 1 to 3, wherein

the mobile body includes a camera, and

the point setting unit sets a direction of an optical axis of the camera based on a line-of-sight direction at the viewpoint position of the selected view image.

[Claim 5]

The information processing apparatus according to any one of claims 1 to 4, wherein

the mobile body includes a camera, and

the point setting unit sets the waypoint at a position in the space for movement at which the camera can generate a shot image corresponding to the selected view image.

[Claim 6]

The information processing apparatus according to any one of claims 1 to 5, wherein the display control unit performs control for displaying the view images on a stereoscopic device.

[Claim 7]

The information processing apparatus according to any one of claims 1 to 6, wherein the display control unit causes a position corresponding to a viewpoint position of each view image to be displayed on a screen associated with map information corresponding to the space for movement.

[Claim 8]

The information processing apparatus according to any one of claims 1 to 7, wherein information on the virtual three-dimensional space is generated based on geographic information provided from an external server.

[Claim 9]

An information processing method for setting a waypoint of a mobile body, the method comprising:

causing a display device to display view images of a virtual three-dimensional space corresponding to a space for movement;

determining a selected view image of the view images displayed; and

setting the waypoint of the mobile body in the space for movement based on a viewpoint position of the selected view image.