vicinity of a moving object is not detected as an object being left, so that the object which is merely left on a side of the moving object is not detected as a suspicious object. However, in the method, in a case where the owner of the luggage does not move as in a case of the owner continually sitting on the chair with the luggage that is put beside their feet as described above, the luggage is falsely detected as an object being left.

[0006]

In addition, neither patent document clearly describes an alert confirmation method. Furthermore, even though an object being left is only displayed to be enclosed in a rectangle, it is difficult to easily grasp information such that how and who has left the object.

[0007]

Embodiments of the present invention are made in view of the above circumstances. Embodiments of the present invention provide a technique capable of easily grasping a situation in which an object has been left after detecting the object being left.

SOLUTION TO PROBLEM

[0008]

According to a first aspect of the present invention, there is provided an information processing apparatus including: a left-behind object detection unit detecting a left-behind object from video data; a left-behind time-point estimation unit estimating a left-behind time-point at which the left-behind object is placed; and a presentation control unit acquiring video data near the estimated left-behind time-point, and presenting at least a part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point, wherein the presentation control unit determines a playback speed of each of a plurality of parts included in the acquired video data based on the estimated left-behind time-point, and wherein the presentation control unit performs a playback for the acquired video data in a reverse direction and causes, during the playback, the playback speed of the part near the estimated left-behind time-point in the acquired video data to be slower than a playback speed of another part, wherein the presentation control unit extracts one or more video frames included in the acquired video data and displays the extracted video frames side by side, and the number of video frames extracted from each of a plurality of parts in the acquired video data is determined based on the estimated left-behind time-point.

[0008a]

According to a second aspect of the present invention, there is provided an An information processing apparatus including: a left-behind object detection unit detecting a left-behind object from video data; a left-behind time-point estimation unit estimating a

left-behind time-point at which the left-behind object is placed; and a presentation control unit acquiring video data near the estimated left-behind time-point, and presenting at least a part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point, wherein the presentation control unit determines a playback speed of each of a plurality of parts included in the acquired video data based on the estimated left-behind time-point, wherein the presentation control unit performs a playback for the acquired video data in a reverse direction and causes, during the playback, the playback speed of the part near the estimated left-behind time-point in the acquired video data to be slower than a playback speed of another part, wherein the left-behind object detection unit includes: a person detection unit executing person detection processing of detecting a person in the vicinity of a target object for each of a first video frame and a second video frame, the target object being an object detected as a stationary object, the first video frame including the target object, the second video frame including the target object and being generated after the first video frame; and a left-behind state determination unit determining a left-behind state by comparing results of the person detection processing for each of the first video frame and the second video frame, and wherein it is determined that the left-behind object is detected in a case where the object is determined to be in a state of being left behind by the left-behind state determination unit, wherein the presentation control unit extracts one or more video frames included in the acquired video data and displays the extracted video frames side by side, and the number of video frames extracted from each of a plurality of parts in the acquired video data is determined based on the estimated left-behind time-point.

[0009]

According to a third aspect of the present invention, there is provided a control method causing a computer to execute: left-behind object detection step of detecting a left-behind object from video data; a left-behind time estimation step of estimating a left-behind time-point at which the left-behind object is placed; and a presentation control step of acquiring video data near the estimated left-behind time-point, and presenting at least part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point, and wherein in the presentation control step, a playback for the acquired video data is performed in a reverse direction and the playback speed of the part near the estimated left-behind time-point in the acquired video data is slower than a playback speed of another part, wherein in the presentation control step, one or more video frames included in the acquired video data are extracted and the extracted video frames are displayed side by side, and the number of video

frames extracted from each of a plurality of parts in the acquired video data is determined based on the estimated left-behind time-point.

[0009a]

According to a fourth aspect of the present invention, there is provided a control method causing a computer to execute: a left-behind object detection step of detecting a left-behind object from video data; a left-behind time estimation step of estimating a left-behind time-point at which the left-behind object is placed; and a presentation control step of acquiring video data near the estimated left-behind time-point, and presenting at least part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point, and wherein in the presentation control step, a playback for the acquired video data is performed in a reverse direction and the playback speed of the part near the estimated left-behind time-point in the acquired video data is slower than a playback speed of another part, wherein the left-behind object detection step includes: a person detection step of executing person detection processing of detecting a person in the vicinity of a target object for each of a first video frame and a second video frame, the target object being an object detected as a stationary object, the first video frame including the target object, the second video frame including the target object and being generated after the first video frame; and a left-behind state determination step of determining a left-behind state by comparing results of the person detection processing for each of the first video frame and the second video frame, and wherein it is determined that the left-behind object is detected in a case where the object is determined to be in a state of being left behind in the left-behind state determination step, wherein in the presentation control step, one or more video frames included in the acquired video data are extracted and the extracted video frames are displayed side by side, and the number of video frames extracted from each of a plurality of parts in the acquired video data is determined based on the estimated left-behind time-point.

[0010]

Disclosed herein is program causing a computer to execute each step of the above control method.

ADVANTAGEOUS EFFECTS OF INVENTION

[0011]

According to embodiments the present invention, there is provided a video providing method of easily grasping a state of an object left behind such that how and who has left the object.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

The above-described aspects, other aspects, features, and advantages will be further clearly described through preferable embodiments described below and accompanying drawings below.

[0013]

Fig. 1 is a diagram illustrating an outline of an operation of an information processing apparatus according to a present example embodiment.

Fig. 2 is a diagram illustrating a configuration of the information processing apparatus according to a first example embodiment.

Fig. 3 is a diagram illustrating a computer which is used to realize the information processing apparatus.

Fig. 4 is a flowchart illustrating a flow of a process executed by the information processing apparatus according to the first example embodiment.

Fig. 5 is a diagram conceptually illustrating a method of detecting a stationary object from video data.

Fig. 6 is a diagram illustrating a configuration of a left-behind object detection unit according to a second example embodiment.

Fig. 7 is a flowchart illustrating a flow of a process executed by the left-behind object detection unit according to the second example embodiment.

Figs. 8 are diagrams illustrating a vicinity region defined as an image region of a part of a video frame.

Fig. 9 is a diagram illustrating a flow of left-behind object determination processing executed by a left-behind object determination unit.

DESCRIPTION OF EMBODIMENTS

[0014]

Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings. Also, in all drawings, the same components are denoted to the same symbols, and description is appropriately not repeated. In addition, unless particularly described, each block in respective block diagram represents a configuration in function units instead of a configuration in hardware units.

CLAIMS

1. An information processing apparatus comprising:

a left-behind object detection unit detecting a left-behind object from video data;

a left-behind time-point estimation unit estimating a left-behind time-point at which the left-behind object is placed; and

a presentation control unit acquiring video data near the estimated left-behind time-point, and presenting at least a part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point,

wherein the presentation control unit determines a playback speed of each of a plurality of parts included in the acquired video data based on the estimated left-behind time-point,

wherein the presentation control unit performs a playback for the acquired video data in a reverse direction and causes, during the playback, the playback speed of the part near the estimated left-behind time-point in the acquired video data to be slower than a playback speed of another part,

wherein the presentation control unit extracts one or more video frames included in the acquired video data and displays the extracted video frames side by side, and

the number of video frames extracted from each of a plurality of parts in the acquired video data is determined based on the estimated left-behind time-point.

2. An information processing apparatus comprising:

a left-behind object detection unit detecting a left-behind object from video data;

a left-behind time-point estimation unit estimating a left-behind time-point at which the left-behind object is placed; and

a presentation control unit acquiring video data near the estimated left-behind time-point, and presenting at least a part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point,

wherein the presentation control unit determines a playback speed of each of a plurality of parts included in the acquired video data based on the estimated left-behind time-point,

wherein the presentation control unit performs a playback for the acquired video data in a reverse direction and causes, during the playback, the playback speed of the part near the estimated left-behind time-point in the acquired video data to be slower than a playback speed of another part,

wherein the left-behind object detection unit includes:

a person detection unit executing person detection processing of detecting a person in the vicinity of a target object for each of a first video frame and a second video frame, the target object being an object detected as a stationary object, the first video frame including the target object, the second video frame including the target object and being generated after the first video frame; and

a left-behind state determination unit determining a left-behind state by comparing results of the person detection processing for each of the first video frame and the second video frame, and

wherein it is determined that the left-behind object is detected in a case where the object is determined to be in a state of being left behind by the left-behind state determination unit,

wherein the presentation control unit extracts one or more video frames included in the acquired video data and displays the extracted video frames side by side, and

the number of video frames extracted from each of a plurality of parts in the acquired video data is determined based on the estimated left-behind time-point.

3. An information processing apparatus comprising:

a left-behind object detection unit detecting a left-behind object from video data;

a left-behind time-point estimation unit estimating a left-behind time-point at which the left-behind object is placed; and

a presentation control unit acquiring video data near the estimated left-behind time-point, and presenting at least a part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point,

wherein the presentation control unit determines a playback speed of each of a plurality of parts included in the acquired video data based on the estimated left-behind time-point,

wherein the presentation control unit performs a playback for the acquired video data in a reverse direction and causes, during the playback, the playback speed of the part near the estimated left-behind time-point in the acquired video data to be slower than a playback speed of another part,

wherein the presentation control unit extracts one or more video frames included in the acquired video data and switches and displays the extracted video frames sequentially, and

the number of video frames extracted from each of a plurality of parts in the acquired video data per unit time is determined based on the estimated left-behind time-point.

4. An information processing apparatus comprising:

a left-behind object detection unit detecting a left-behind object from video data;

a left-behind time-point estimation unit estimating a left-behind time-point at which the left-behind object is placed; and

a presentation control unit acquiring video data near the estimated left-behind time-point, and presenting at least a part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point,

wherein the presentation control unit determines a playback speed of each of a plurality of parts included in the acquired video data based on the estimated left-behind time-point,

wherein the presentation control unit performs a playback for the acquired video data in a reverse direction and causes, during the playback, the playback speed of the part near the estimated left-behind time-point in the acquired video data to be slower than a playback speed of another part,

wherein the left-behind object detection unit includes:

a person detection unit executing person detection processing of detecting a person in the vicinity of a target object for each of a first video frame and a second video frame, the target object being an object detected as a stationary object, the first video frame including the target object, the second video frame including the target object and being generated after the first video frame; and

a left-behind state determination unit determining a left-behind state by comparing results of the person detection processing for each of the first video frame and the second video frame, and

wherein it is determined that the left-behind object is detected in a case where the object is determined to be in a state of being left behind by the left-behind state determination unit,

wherein the presentation control unit extracts one or more video frames included in the acquired video data and switches and displays the extracted video frames sequentially, and

the number of video frames extracted from each of a plurality of parts in the acquired video data per unit time is determined based on the estimated left-behind time-point.

5. The information processing apparatus according to any one of claims 1 to 4, wherein the presentation control unit displays the extracted video frames in an order from a latest generation time-point.

6. The information processing apparatus according to any one of claims 1 to 5, wherein the presentation control unit sets the number of video frames extracted from the video data near the estimated left-behind time-point per unit time to be greater than the number of video frames extracted from video data in another period per unit time.

7. The information processing apparatus according to any one of claims 1 to 6, wherein the presentation control unit presents information on the detected left-behind object together with at least a part of the acquired video data.

8. A control method causing a computer to execute:

a left-behind object detection step of detecting a left-behind object from video data;

a left-behind time estimation step of estimating a left-behind time-point at which the left-behind object is placed; and

a presentation control step of acquiring video data near the estimated left-behind time-point, and presenting at least part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point, and

wherein in the presentation control step, a playback for the acquired video data is performed in a reverse direction and the playback speed of the part near the estimated left-behind time-point in the acquired video data is slower than a playback speed of another part,

wherein in the presentation control step, one or more video frames included in the acquired video data are extracted and the extracted video frames are displayed side by side, and

the number of video frames extracted from each of a plurality of parts in the acquired video data is determined based on the estimated left-behind time-point.

9. A control method causing a computer to execute:

a left-behind object detection step of detecting a left-behind object from video data;

a left-behind time estimation step of estimating a left-behind time-point at which the left-behind object is placed; and

a presentation control step of acquiring video data near the estimated left-behind time-point, and presenting at least part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point, and

wherein in the presentation control step, a playback for the acquired video data is performed in a reverse direction and the playback speed of the part near the estimated left-behind time-point in the acquired video data is slower than a playback speed of another part,

wherein the left-behind object detection step includes:

a person detection step of executing person detection processing of detecting a person in the vicinity of a target object for each of a first video frame and a second video frame, the target object being an object detected as a stationary object, the first video frame including the target object, the second video frame including the target object and being generated after the first video frame; and

a left-behind state determination step of determining a left-behind state by comparing results of the person detection processing for each of the first video frame and the second video frame, and

wherein it is determined that the left-behind object is detected in a case where the object is determined to be in a state of being left behind in the left-behind state determination step,

wherein in the presentation control step, one or more video frames included in the acquired video data are extracted and the extracted video frames are displayed side by side, and

the number of video frames extracted from each of a plurality of parts in the acquired video data is determined based on the estimated left-behind time-point.

10. A control method causing a computer to execute:

a left-behind object detection step of detecting a left-behind object from video data;

a left-behind time estimation step of estimating a left-behind time-point at which the left-behind object is placed; and

a presentation control step of acquiring video data near the estimated left-behind time-point, and presenting at least part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point, and

wherein in the presentation control step, a playback for the acquired video data is performed in a reverse direction and the playback speed of the part near the estimated left-behind time-point in the acquired video data is slower than a playback speed of another part,

wherein in the presentation control step, one or more video frames included in the acquired video data are extracted and the extracted video frames are switched and displayed sequentially, and

the number of video frames extracted from each of a plurality of parts in the acquired video data per unit time is determined based on the estimated left-behind time-point.

11. A control method causing a computer to execute:

a left-behind object detection step of detecting a left-behind object from video data;

a left-behind time estimation step of estimating a left-behind time-point at which the left-behind object is placed; and

a presentation control step of acquiring video data near the estimated left-behind time-point, and presenting at least part of the acquired video data by controlling a method of presenting the acquired video data based on the estimated left-behind time-point, and

wherein in the presentation control step, a playback for the acquired video data is performed in a reverse direction and the playback speed of the part near the estimated left-behind time-point in the acquired video data is slower than a playback speed of another part,

wherein the left-behind object detection step includes:

a person detection step of executing person detection processing of detecting a person in the vicinity of a target object for each of a first video frame and a second video frame, the target object being an object detected as a stationary object, the first video frame including the target object, the second video frame including the target object and being generated after the first video frame; and

a left-behind state determination step of determining a left-behind state by comparing results of the person detection processing for each of the first video frame and the second video frame, and

wherein it is determined that the left-behind object is detected in a case where the object is determined to be in a state of being left behind in the left-behind state determination step,

wherein in the presentation control step, one or more video frames included in the acquired video data are extracted and the extracted video frames are switched and displayed sequentially, and

the number of video frames extracted from each of a plurality of parts in the acquired video data per unit time is determined based on the estimated left-behind time-point.

12. The control method according to any one of claims 8 to 11, wherein in the presentation control step, the extracted video frames are displayed in an order from a latest generation time-point.

13. The control method according to any one of claims 8 to 12, wherein in the presentation control step, the number of video frames extracted from the video data near the estimated left-behind time-point per unit time is set to be greater than the number of video frames extracted from video data in another period per unit time.

14. The control method according to any one of claims 8 to 13, wherein in the presentation control step, information on the detected left-behind object is presented together with at least a part of the acquired video data.