For specific implementations, reference may be made to the description in the foregoing distance measurement method embodiments. For the purpose of brevity, details are not described herein again.

FIG. 8 is a block diagram of an intelligent control apparatus according to one embodiment of the present disclosure. As shown in FIG. 8, the intelligent control apparatus includes:

a distance obtaining module 1, configured to obtain a distance between a current object and a target object according to any claim of the distance measurement method; and

a control information generating module 2, configured to generate early warning information and/or control information for the current object according to the distance.

In the embodiments, the early warning information and/or the control information for the current object is generated according to the obtained distance between the current object and the target object, so that the current object may take a corresponding measure according to the early warning information and/or the control information.

In one possible implementation, the current object includes one or any combination of the following objects: a person, a vehicle, a robot, a wearable device, a blind guide device, a monitoring device, an intelligent terminal device, a production device, and a building.

In one possible implementation, the control information generating module 2 includes: a first control information generating module, configured to generate the early warning information and/or the control information for the current object according to the distance and a distance threshold.

In the embodiments, the distance threshold may be set, and after the obtained distance is compared with the distance threshold, the early warning information and/or the control information for the current object is generated according to the comparison result. The early warning information and/or the control information for the current object may be generated when the obtained distance is greater than the distance threshold. It is possible to reduce the number of times an intelligent control system sends early warning information with little warning significance and/or unnecessary intelligent control according to control

CLAIMS

1. A distance measurement method, comprising:

obtaining a detection bounding box of a target object in an image photographed by a current object;

determining at least one distance measurement point according to the shape of the detection bounding box; and

determining a distance between the target object and the current object based on the distance measurement point.

2. The method according to claim 1, wherein the detection bounding box comprises a rectangular bounding box, and determining at least one distance measurement point according to the shape of the detection bounding box comprises:

determining the at least one distance measurement point according to the height of the rectangular bounding box.

3. The method according to claim 2, wherein determining the at least one distance measurement point according to the height of the rectangular bounding box comprises:

determining the at least one distance measurement point on the bottom edge of the rectangular bounding box according to the height of the rectangular bounding box.

4. The method according to claim 3, wherein determining the distance measurement point on the bottom edge of the rectangular bounding box according to the height of the rectangular bounding box comprises:

determining a height weight coefficient according to an aspect ratio and an aspect ratio threshold of the rectangular bounding box; and

determining the distance measurement point on the bottom edge of the rectangular bounding box according to the height of the rectangular bounding box and the height weight coefficient.

5. The method according to any one of claims 1 to 4, wherein determining the distance between the target object and the current object based on the distance measurement point comprises:

determining the distance between the target object and the current object based on the distance measurement point and a homography matrix constructed based on an environment where the current object is located.

6. The method according to claim 5, wherein determining the distance between the target object and the current object based on the distance measurement point and the homography matrix comprises:

determining a first distance between the target object and the current object based on the distance measurement point and a first homography matrix, the first homography matrix comprising a homography matrix of a first distance range; and

determining a second distance between the target object and the current object according to the determined first distance and a second homography matrix, the second homography matrix comprising a homography matrix of a second distance range, and the first distance range being greater than the second distance range.

7. The method according to any one of claims 1 to 6, wherein obtaining the detection bounding box of the target object in the image photographed by the current object comprises:

performing target object detection, based on a neural network, on the image photographed by the current object to obtain the detection bounding box of the target object.

8. The method according to any one of claims 1 to 7, wherein the image is a frame image in a video photographed by the current object, and obtaining the detection bounding box of the target object in the image photographed by the current object comprises:

performing target object detection on the image to obtain a first detection bounding box of the target object;

obtaining a historical detection bounding box of the target object in at least one frame image earlier in time sequence than the image in the video;

determining a predicted bounding box of the target object in the image according to the historical detection bounding box of the target object; and

determining a second detection bounding box of the target object according to the first

detection bounding box and the predicted bounding box.

9. The method according to claim 8, wherein determining the predicted bounding box of the target object in the image according to the historical detection bounding box of the target object comprises:

determining a motion state of the target object according to the historical detection bounding box of the target object, and fitting the predicted bounding box of the target object according to the motion state of the target object;

and/or

determining a change state of an aspect ratio of the historical detection bounding box according to the historical detection bounding box of the target object, and fitting an aspect ratio of the predicted bounding box of the target object according to the change state of the aspect ratio of the historical detection bounding box.

10. The method according to claim 8, wherein determining the second detection bounding box of the target object according to the first detection bounding box and the predicted bounding box comprises:

determining a first overlapping rate between the first detection bounding box of the target object and the predicted bounding box of the target object; when the first overlapping rate is greater than or equal to a first overlapping threshold, determining a detection position of the target object according to the position of the first detection bounding box of the target object and the position of the predicted bounding box of the target object; determining a detection aspect ratio of the target object according to an aspect ratio of the first detection bounding box of the target object and the aspect ratio of the predicted bounding box of the target object; and determining the second detection bounding box of the target object according to the detection position and the detection aspect ratio;

and/or

when the first detection bounding box of the target object is not obtained by performing target object detection on the image, determining the predicted bounding box of the target object as the second detection bounding box of the target object;

and/or

when the historical detection bounding box of the target object overlaps a historical detection bounding box of another object, obtaining a second overlapping rate between the historical detection bounding box of the target object and the historical detection bounding box of the another object; calculating a third overlapping rate between the historical detection bounding box of the target object and the first detection bounding box of the target object in a previous frame image of the image; and when the third overlapping rate is greater than the second overlapping rate, determining the first detection bounding box of the target object as the second detection bounding box of the target object.

11. The method according to claim 10, wherein the method further comprises:

when the first overlapping rate is less than the first overlapping threshold, determining the first detection bounding box of the target object as the second detection bounding box of the target object.

12. An intelligent control method, comprising:

obtaining a distance between a current object and a target object by using the method according to any one of claims 1 to 11; and

generating early warning information and/or control information for the current object according to the distance.

13. The method according to claim 12, wherein the current object comprises one or any combination of the following objects: a person, a vehicle, a robot, a wearable device, a blind guide device, a monitoring device, an intelligent terminal device, a production device, and a building;

and/or

the early warning information comprises one or any combination of the following information: sound early warning information, light early warning information, text early warning information, image early warning information, and vibration information;

and/or

the control information comprises one or any combination of the following

information: emergency brake information, stop information, acceleration information, deceleration information, and turn information.

14. The method according to claim 12 or 13, wherein generating early warning information and/or control information for the current object according to the distance comprises:

generating the early warning information and/or the control information for the current object according to the distance and a distance threshold;

and/or

determining an early warning level according to the distance, and determining the early warning information according to the early warning level;

and/or

determining a control level according to the distance, and determining the control information according to the control level.

15. The method according to claim 14, wherein generating the early warning information and/or the control information for the current object according to the distance and the distance threshold comprises:

when the distance is less than or equal to the distance threshold, generating first early warning information and/or first control information for the current object; and

when the distance is greater than the distance threshold, generating second early warning information and/or second control information for the current object.

16. A distance measurement apparatus, comprising:

a detection bounding box obtaining module, configured to obtain a detection bounding box of a target object in an image photographed by a current object;

a distance measurement point determining module, configured to determine at least one distance measurement point according to the shape of the detection bounding box; and

a distance determining module, configured to determine a distance between the target object and the current object based on the distance measurement point.

17. An intelligent control apparatus, comprising:

a distance obtaining module, configured to obtain a distance between a current object and a target object by using the apparatus according to claim 16; and

a control information generating module, configured to generate early warning information and/or control information for the current object according to the distance.

18. An electronic device, comprising:

a processor; and

a memory configured to store processor executable instructions;

wherein the processor is configured to: execute the method according to any one of claims 1 to 15.

19. A computer readable storage medium, having computer program instructions stored thereon, wherein when the computer program instructions are executed by a processor, the method according to any one of claims 1 to 15 is implemented.

20. A computer program, wherein when the computer program is executed by a processor, the method according to any one of claims 1 to 15 is implemented.