Claims

1. A method of performing security inspection of human body based on millimeter-wave, comprising:

displaying, by a first display device, information related to a designated posture to a person to be inspected before the person to be inspected enters an inspection channel defined by a millimeter-wave human body security inspection instrument, wherein the designated posture is expected to be taken by the person to be inspected when scanning the person to be inspected with the millimeter-wave human body security inspection instrument;

guiding the person to be inspected to enter the inspection channel and stand at a designated standing position within the inspection channel in a standing posture substantially complying with the designated posture;

scanning, by the millimeter-wave human body security inspection instrument, the person to be inspected, so as to obtain millimeter-wave scanning data of the person to be inspected; and

performing, by a workstation, a reconstruction of millimeter-wave scanning image of the person to be inspected, a confirmation for the standing posture of the person to be inspected, and a recognition of a suspected item of the person to be inspected, based on the millimeter-wave scanning data,

wherein the method further comprises:

guiding the person to be inspected to leave the inspection channel after determining that the standing posture of the person to be inspected meets a requirement of the designated posture; and

analyzing a reconstructed millimeter-wave scanning image to recognize whether the person to be inspected is carrying the suspected item or not when the person to be inspected is leaving the inspection channel.

2. The method of performing security inspection of human body based on millimeter-wave of claim 1, wherein the first display device is disposed at a top of the millimeter-wave human body security inspection instrument, so as to allow the person to be inspected to see the information displayed by the first display device before entering the inspection channel.

3. The method of performing security inspection of human body based on millimeter-wave of claim 1, wherein at least one of a video of posing the designated posture, a text of prompting the designated posture, or a picture of the designated posture is displayed to the person to be inspected by the first display device.

4. The method of performing security inspection of human body based on millimeter-wave of any one of claims 1 to 3, further comprising:

displaying, by a second display device, information related to the designated posture to the person to be inspected standing at the designated standing position within the inspection channel.

5. The method of performing security inspection of human body based on millimeter-wave of claim 4, wherein an image of a character in the designated posture is displayed by the second display device, and

wherein the method further comprises:

acquiring a visible light image of the person to be inspected standing at the designated standing position in the standing posture, and displaying the visible light image on the second display device, so as to guide the person to be inspected to adjust the standing posture of the person to be inspected according to a comparison between the visible light image and the image of the character in the designated posture.

6. The method of performing security inspection of human body based on millimeter-wave of any one of claims 1 to 5, further comprising:

guiding, by an audio device, the person to be inspected to see the information displayed by the first display device and/or to stand at the designated standing position in the standing posture substantially complying with the designated posture through a voice prompt.

7. The method of performing security inspection of human body based on millimeter-wave of any one of claims 1 to 5, wherein determining whether the standing posture of the person to be inspected meets a requirement of the designated posture or not is performed based on a reconstructed millimeter-wave scanning image.

8. The method of performing security inspection of human body based on millimeter-wave of any one of claims 1 to 5, further comprising:

performing, by a graphics processing unit GPU at the workstation, the reconstruction of millimeter-wave scanning image of the person to be inspected, the confirmation for the standing posture of the person to be inspected and the recognition of the suspected item of the person to be inspected.

9. The method of performing security inspection of human body based on millimeter-wave of any one of claims 1 to 5, further comprising:

acquiring a first scanning dataset related to a front of the person to be inspected and a second scanning dataset related to a back of the person to be inspected, wherein a column direction of the first scanning dataset and a column direction of the second scanning dataset are identical to a height direction of the person to be inspected;

combining, in a row direction of the first scanning dataset, columns of the first scanning dataset to obtain a column of first combined data represented by Y1, and combining, in a row direction of the second scanning dataset, columns of the second scanning dataset to obtain a column of second combined data represented by Y2;

performing a cross-correlation operation on the first combined data Y1 and the second combined data Y2 according to an equation:

$$R(\tau) = \int Y_1(t)Y_2(t+\tau)dt,$$

where t is a height corresponding to the first combined data Y1 or the second combined data Y2; and

determining a value of τ corresponding to a maximum of $R(\tau)$ as a height difference between the first scanning dataset and the second scanning dataset, and performing a registration between the first scanning dataset and the second scanning dataset based on the height difference, so as to perform the reconstruction of millimeter-wave scanning image of the person to be inspected.

10. A system of performing security inspection of human body based on millimeter-wave, comprising:

a millimeter-wave human body security inspection instrument (100), wherein the millimeter-wave human body security inspection instrument (100) defines an inspection channel (101), and is configured to scan a person to be inspected standing at a designated standing position within the inspection channel (101), so as to acquire millimeter-wave scanning data of the person to be inspected;

a first display device (120) disposed at a position which is viewable by the person to be inspected before the person to be inspected enters the inspection channel, wherein the first display device (120) is configured to display information related to a designated posture, which is expected to be taken by the person to be inspected when scanning the person to be inspected with the millimeter-wave human body security inspection instrument; and

a workstation (200) configured to perform a reconstruction of millimeter-wave scanning image of the person to be inspected, a confirmation for a standing posture of the person to be inspected and a recognition of a suspected item of the person to be inspected based on the millimeter-wave scanning data,

wherein the system of performing security inspection of human body based on millimeter-wave is configured to guide the person to be inspected to leave the inspection channel through a voice prompt and/or a visual prompt after determining that the standing posture of the person to be inspected meets a requirement of the designated posture, and

the workstation is configured to analyze a reconstructed millimeter-wave scanning image to recognize whether the person to be inspected is carrying the suspected item or not when the person to be inspected is leaving the inspection channel.

11. The system of performing security inspection of human body based on millimeter-wave of claim 10, wherein the first display device is disposed at a top of the millimeter-wave human body security inspection instrument to face to the person to be inspected being about to enter the inspection channel.

12. The system of performing security inspection of human body based on millimeter-wave of claim 11, wherein a number of first display devices is two, and each of two opposite tops of the millimeter-wave human body security inspection instrument is provided with one first display device in a passing direction of the person to be inspected.

13. The system of performing security inspection of human body based on millimeter-wave of claim 10, wherein the first display device is configured to display at least one of a video of posing the designated posture, a text of prompting the designated posture, or a picture of the designated posture to the person to be inspected.

14. The system of performing security inspection of human body based on millimeter-wave of any one of claims 10 to 13, further comprising:

a second display device (130) disposed within the inspection channel to display information related to the designated posture to the person to be inspected standing at the designated standing position.

15. The system of performing security inspection of human body based on millimeter-wave of claim 14, further comprising:

a visible light imaging device configured to acquire a visible light image of the person to be inspected standing at the designated standing position in the standing posture,

wherein the second display device is configured to display an image of a character in the designated posture and the visible light image to guide the person to be inspected to adjust the standing posture of the person to be inspected according to a comparison between the visible light image and the image of the character in the designated posture.

16. The system of performing security inspection of human body based on millimeter-wave of any one of claims 10 to 15, further comprising:

an audio device (300) configured to guide the person to be inspected to see the information displayed by the first display device and/or to stand at the designated standing position in the standing posture substantially complying with the designated posture through a voice prompt.

17. The system of performing security inspection of human body based on millimeter-wave of any one of claims 10 to 15, wherein the workstation is configured to determine whether the standing posture of the person to be inspected meets a requirement of the designated posture or not based on a reconstructed millimeter-wave scanning image.

18. The system of performing security inspection of human body based on millimeter-wave of any one of claims 10 to 15, wherein the workstation comprises a graphics processing unit GPU configured to perform the reconstruction of millimeter-wave scanning image of the person to be inspected, the confirmation for the standing posture of the person to be inspected and the recognition of the suspected item of the person to be inspected.

19. The system of performing security inspection of human body based on millimeter-wave of any one of claims 10 to 15, wherein the millimeter-wave human body security inspection instrument comprises:

a first millimeter-wave scanning unit and a second millimeter-wave scanning unit on opposite sides of the inspection channel in a horizontal direction perpendicular to a direction of the person to be inspected passing through the inspection channel, wherein the first millimeter-wave scanning unit and the second millimeter-wave scanning unit are configured to perform millimeter-wave scanning on a front of the person to be inspected and a back of the person to be inspected standing at the designated standing position in the standing posture complying with the designated posture, respectively, so as to obtain a first scanning dataset related to the front of the person to be inspected and a second scanning dataset related to the back of the person to be inspected, and wherein a column direction of the first scanning dataset and a column direction of the second scanning dataset are identical to a height direction of the person to be inspected, and

wherein the workstation is further configured to:

combine, in a row direction of the first scanning dataset, columns of the first scanning dataset to obtain a column of first combined data represented by Y1, and combine, in a row direction of the second scanning dataset, columns of the second scanning dataset to obtain a column of second combined data represented by Y2;

perform a cross-correlation operation on the first combined data Y1 and the second combined data Y2 according to an equation:

$$R(\tau) = \int Y_1(t)Y_2(t+\tau)dt,$$

where t is a height corresponding to the first combined data Y1 or the second combined data Y2; and

determine a value of τ corresponding to a maximum of $R(\tau)$ as a height difference between the first scanning dataset and the second scanning dataset, and perform a registration between the first scanning dataset and the second scanning dataset based on the height difference, so as to perform the reconstruction of millimeter-wave scanning image of the person to be inspected.