

Human Body Radiation Examining Method and Human Body Radiation Examining System

5 **BACKGROUND OF THE INVENTION**

Field of the Invention

Embodiments of the present invention relate to a human body radiation examining method and a human body radiation examining system for used in the field of security inspection, such as in an airport, a station, the Customs and the like, and/or the field of radiation human body medical treatment such as in a hospital.

Description of Related Art

Human body radiation security inspection is widely used in an airport, the Customs, a station and other places. Common radiation examining techniques comprises a radiation perspective imaging technique and a radiation back-scattered imaging technique. The radiation perspective imaging technique causes a radiation to be transmitted through a human body to be inspected so as to form a human body perspective image after analyzing and processing a radiation signal transmitting through a human body by a computer. The radiation perspective imaging technique is a main technical means for detecting an object hiding within the human body. The radiation back-scattered technique uses a trace amount of radiation to scan the human body to be inspected so as to obtain a human body surface profile image by receiving a radiation signal scattered back from a human body surface. This technique can effectively detect dangerous goods carried by the human body.

25 A personal radiation dose limit refers to an upper limit of radiation dose permitted for an individual or a lower limit of radiation dose unpermitted for the individual. Different radiation guarding systems stipulate corresponding dose limits. The dose limit involves a single radiation dose limit and an annual accumulative radiation dose limit. A human body radiation examining device needs to satisfy requirements for the dose limit so as to ensure the security of a human body.

However, an existing human body radiation examining device only considers a single radiation dose of a person to satisfy the requirement for radiation guard. However, there is no way to directly measure and control an accumulative radiation dose of a person in a predetermined period. As people in modern society are exposed to more and more radiation inspection, it is necessary to consider the influence of the accumulative radiation dose on human health.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a human body radiation examining

system and a human body radiation examining method which are much safer to a person to be examined, and which can monitor and manage a single radiation dose of a person and an accumulative radiation dose of the person in different human body radiation examining devices in a predetermined period so as to avoid an excessive radiation dose applied to a person and cause health hazard.

According to an aspect of embodiments of the present invention, there is provided a human body radiation examining method comprising steps of: identifying a person to be examined; retrieving an accumulative radiation dose of the person according to identification result; obtaining a predicted single radiation scanning dose of a human body radiation examining device intended to perform a current radiation examination; calculating a sum value of the accumulative radiation dose of the person and the predicted single radiation scanning dose of the human body radiation examining device; and determining whether to perform the current radiation examination on the person according to a judgment whether the sum value exceeds a dose limit.

According to an exemplary embodiment of the present invention, the predicted single radiation scanning dose of the human body radiation examining device is a rated single radiation scanning dose of the human body radiation examining device.

According to an exemplary embodiment of the present invention, the accumulative radiation dose is an accumulated value of radiation doses already received by the person in a year; and

the dose limit is an upper limit of an accumulated value of radiation doses permitted for the person in a year.

According to an exemplary embodiment of the present invention, determining whether to perform the current radiation examination on the person according to a judgment whether the sum value exceeds a dose limit comprises:

determining not to perform the current radiation examination on the person if the sum value of the accumulative radiation dose of the person and the rated single radiation scanning dose of the human body radiation examining device exceeds the dose limit; and

determining to perform the current radiation examination on the person if the sum value of the accumulative radiation dose of the person and the rated single radiation scanning dose of the human body radiation examining device does not exceed the dose limit.

According to an exemplary embodiment of the present invention, the method further comprises:

monitoring an output parameter of the human body radiation examining device at real time during performing the radiation examination on the person and stopping the radiation examination if the output parameter is abnormal; and

calculating a radiation dose having been received by the person in the current partial radiation examination according to a ratio of a time period during which the current partial

radiation examination is performed to a time period during which an entire radiation examination is to be performed.

According to an exemplary embodiment of the present invention, the method further comprises: after performing the radiation examination on the person, obtaining a current
5 radiation dose of the person and transmitting a datum of the current radiation dose to a cloud server to update an annual accumulative value of radiation dose of the person.

According to an exemplary embodiment of the present invention, the step of obtaining a current radiation dose of the person comprises:

obtaining a radiation scanning image of the person being examined currently; and
10 processing the radiation scanning image to obtain the current radiation dose of the person based on an average single pixel intensity value of a residual pixel region expect a human body image region in the radiation scanning image by converting with a converting coefficient, wherein the average single pixel intensity value is an average intensity value of
15 respective pixels in the residual pixel region expect the human body image region in the radiation scanning image.

According to an exemplary embodiment of the present invention, the current radiation dose of the person is calculated by the following formula:

$$Y=Y1 \cdot X/X1$$

wherein X is the average single pixel intensity value in the residual pixel region in the
20 current radiation scanning image, Y1 is a value of the rated single radiation scanning dose of the human body radiation examining device during the current human body radiation examination, X1 is a single pixel intensity value in a scanning image obtained with no person or object is scanned, corresponding to the rated single radiation scanning dose during the current human body radiation examination.

25 According to an exemplary embodiment of the present invention, the step of obtaining a current radiation dose of the person comprises:

obtaining the rated single radiation scanning dose of the human body radiation examining device during the current human body radiation examination as the current radiation dose of the person.

30 According to an exemplary embodiment of the present invention, the step of obtaining a current radiation dose of the person comprises:

the person carrying a personal radiation dosimeter upon being examined, and the current radiation dose of the person is measured by the personal radiation dosimeter at real time.

35 According to an exemplary embodiment of the present invention, the dose limit is variably assigned.

According to another aspect of the present invention, there is provided a human body radiation examining system comprising: at least one human body radiation examining

device configured to examine a human body with a radiation; a personal identification device configured to identify an identity information of a person and send the identity information to the at least one human body radiation examining device; a cloud server configured to store a single radiation dose information of the person during each radiation examination in one year and an annual accumulative radiation dose information; and a data processor configured to obtain a rated single radiation dose from the at least one human body radiation examining device and an annual accumulative radiation dose of the person from the cloud server and calculate a sum value of the rated single radiation dose and the annual accumulative radiation dose to determine whether to perform a current radiation examination on the person according to a judgment whether the sum value exceeds a dose limit.

According to an exemplary embodiment of the present invention, the human body radiation examining system comprises a plurality of human body radiation examining devices each communicated with the cloud server to transmit data of the single radiation dose of the person at each human body radiation examining device during each radiation examination to the cloud server and accumulate the annual radiation dose so as to establish a data base including a personal radiation dose information for each radiation examination in one year and information of the annual accumulative radiation dose.

According to an exemplary embodiment of the present invention, the plurality of human body radiation examining devices are the same or different types of human body radiation examining device.

According to an exemplary embodiment of the present invention, the dose limit is stored in the cloud server, and the dose limit is variably assigned by the cloud server.

According to an exemplary embodiment of the present invention, the data processor is integrated into each human body radiation examining device or into the cloud server.

According to an exemplary embodiment of the present invention, the personal identification device is integrated into each human body radiation examining device.

According to an exemplary embodiment of the present invention, the human body radiation examining system comprises a single human body radiation examining device, into which the personal identification device, the cloud server and the data processor are integrated.

According to an exemplary embodiment of the present invention, the system further comprises a personal radiation dosimeter, the personal radiation dosimeter is carried by the person being examined for measuring the single radiation dose of the person.

According to an exemplary embodiment of the present invention, the human body radiation examining device comprises:

- a radiation generator or a radiation source for emitting radiations;
- a detector set configured to receive the radiations and generate electrical signals;

an image generation unit configured to convert the electrical signals of the detector set into a radiation scanning image; and

a dose determination unit configured to extract intensity values of respective pixels in a residual pixel region expect a human body image in the radiation scanning image and
5 calculate an average value of the intensity values of the respective pixels in the residual pixel region as an average single pixel intensity value so as to obtain a current radiation dose of the person by converting with a concerting coefficient based on the average single pixel intensity value.

The human body radiation examining method and the human body radiation examining
10 system according to the embodiments of the present invention can monitor and manage the single radiation dose, an accumulative radiation dose and an annual accumulative radiation dose of a person so as to ensure the radiation dose received by the person will not exceed the dose limit, thereby preventing radiation accidents.

In addition, since the current actual radiation dose of the person is converted at real
15 time according to the average single pixel intensity value in the residual pixel region, or is measured at real time by using the personal radiation dosimeter, it is possible to accurately obtain the actual current radiation dose of the person, thereby further improving the security of the human body radiation examining device.

Other objects and advantages of the present invention will be apparent by the following
20 description of embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic view of a human body radiation examining system according to an exemplary embodiment of the present invention;

25 Figure 2 is a block diagram of a basic construction of a human body radiation examining device according to an exemplary embodiment of the present invention;

Figure 3 is a schematic view of a radiation scanning image of a person being examined; and

Figure 4 is a flow chart of a method for examining a human body using the human
30 body radiation examining system as shown in Figure 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the disclosure will be clearly and completely described hereinafter with reference the accompanying drawings in exemplary embodiments of the disclosure.
35 Obviously, the described embodiments are merely part of the embodiments of the disclosure, rather than all of the embodiments of the disclosure. Based on the embodiments of the disclosure, all other embodiments made by those skilled in the art without any inventive step will fall within the scope of the disclosure.

In addition, in the below detail description, for easy to explain, many specific details are set forth to provide a complete understanding to the disclosure. However, one or more embodiments can be obviously carried out without these specific details. In other cases, well-known structures and devices are illustrated to simplify the drawings.

5 In the following detail description, a number of specific details are set forth to provide a complete understanding to embodiments of the disclosure. However, one or more embodiments can be obviously carried out without these specific details. In other cases, well-known structures and devices are illustrated to simplify the drawings. Further, in all accompanying drawings, the same reference numeral is used to denote the same component or part.

10 Figure 1 is a schematic view of a human body radiation examining system according to an exemplary embodiment of the present invention. As shown in Figure 1, the human body radiation examining system generally comprises a personal identification device 11 and a human body radiation examining device 12 at a user end 10 and a dose information server 15 20 at a network end (cloud end).

The personal identification device 10 registers or identifies an identity information of a person to be examined and sends the identity information to the human body radiation examining device 12. The personal identification device 10 includes an identification card reader, a fingerprint identification unit, a 2-dimensional bar code scanning gun, a M1 card reader and the like, for example.

20 The human body radiation examining device 12 performs a safety or medical examination on a human body with radiations. The human body radiation examining device 12 can interact and communicate with the cloud server 20, and transmit the identity information of the person identified by the personal identification device 10 to the cloud server 20 and receive an annual accumulative radiation dose information of the person from the cloud server 20.

30 The cloud server 20 can communicate with the human body radiation examining device 12 to receive data of a single radiation dose of the person being examined each time, and automatically accumulate the data to obtain data of an accumulative radiation dose of the person such as a value of an annual accumulative radiation dose of the person and store the relevant data into the cloud server 20. The cloud server 20 may further store information such as a personal ID, an ID of a radiation scanning device, a scanning time, a single dose, an annual accumulative dose, an annual accumulative dose limit.

35 Although Figure 1 schematically shows one human body radiation examining device 12, according to other embodiments of the present invention, the human body radiation examining device may include a plurality of human body radiation examining devices, each of which communicates with the cloud server 20 so as to form a dose monitoring network. The cloud server serves to manage all the human body radiation examining devices 12 in the

network. This network may be large or small. The smallest network may only include one human body radiation examining device. For example, in a case where the human body radiation examining device is applied in a prison, there may be only one human body radiation examining device to perform examination. Further, the dose limit stored in the cloud server 20 may be variably assigned and particularly determined according to local laws and regulations, industrial standards and the like regarding radiation protection. In some occasions, different dose limits may be applied to different persons according to gender, age or the like. All these information can be stored in a cloud server for use.

When the plurality of human body radiation examining devices 12 are networked, each of the plurality of human body radiation examining devices 12 is communicated with the cloud server 20 to transmit data of a single radiation dose of the person at each human body radiation examining device 12 during each examination to the cloud server so as to establish a database including information of each single radiation dose of the person during each examination in one year and an annual accumulative radiation dose of the person. The plurality of human body radiation examining devices may be of the same or different type. Each of the human body radiation examining devices may have different rated single radiation scanning doses based on different parameter settings.

The plurality of human body radiation examining devices 12 may be remotely or proximally communicated with the cloud server 20. A network connection between the plurality of human body radiation examining devices 12 and the cloud server 20 may be realized in a wired or wireless manner. The network connection may be a local network formed by several apparatuses. It may also be a cross-regional public network. Therefore, the human body radiation examining system of the present disclosure may realize information sharing and co-management of a plurality of apparatuses so as to maximally secure the safety of a personal during radiation examination or inspection.

In addition, the human body radiation examining system according to the embodiments as described above further comprises a data processor 30. Figure 1 shows an example in which the data processor 30 is integrated into the cloud server 20. The data processor is configured to obtain a rated single radiation scanning dose from the at least one of the human body radiation examining devices 12 and an annual accumulative radiation dose of the person from the cloud server 20 and calculate a sum value of the two doses to determine whether to perform a radiation examination on the person according to a judgment whether the sum value exceeds a dose limit.

Specifically, if the sum value of the annual accumulative radiation dose of the person and the rated single radiation scanning dose of the human body radiation examining device exceeds the dose limit, it is determined not to perform the current radiation examination on the person; and if the sum value of the annual accumulative radiation dose of the person and the rated single radiation scanning dose of the human body radiation examining device does

not exceed the dose limit, it is determined to perform the current radiation examination on the person.

In the example shown in Figure 1, the data processor 30 is integrated into the cloud server 20. In this case, when performing an examination on a human body of a person, the cloud server 20 may obtain a personal identity information of the person to be examined and a rated single radiation scanning dose from the current human body radiation examining device 12 to perform the current examination. Then, the data processor 30 will add the rated single radiation scanning dose of the current human body radiation examining device 12 and an annual accumulative radiation dose of the person to obtain a sum value at the cloud server 20. Thereafter, it is determined whether to perform the current radiation examination on the person according to the judgment whether the sum value exceeds the dose limit set by the cloud server 20, and the determination result is then sent to the human body radiation examining device 12.

According to other embodiments of the present invention, when there are a plurality of human body radiation examining devices, a data processor 30 may also be integrated into each human body radiation examining device 12. In this case, when performing an radiation examination on a human body of a person, the current human body radiation examining device 12 performing the current examination may transmit the personal identity information of the person identified by the personal identification device 10 to the cloud server 20 and obtain a value of an annual accumulative radiation dose of the person from the cloud server 20. Then, the data processor integrated into the human body radiation examining device 12 performing the current examination will add a rated single radiation scanning dose of the current human body radiation examining device 12 and the annual accumulative radiation dose of the person to obtain a sum value of the doses. Thereafter, it is determined whether to perform the current radiation examination on the person according to a judgment whether the sum value exceeds the dose limit set by the cloud server 20 or not.

As an example, the personal identification device 11 may be a device independent of the human body radiation examining device 12. For example, the personal identification device 11 may be separately placed on a console or held in hand by an operator. Alternatively, the personal identification device 11 may also be integrated into each human body radiation examining device 12, for example, fixed on a surface of the human body radiation examining device 12.

When the human body radiation examining system comprises a single human body radiation examining device 12, the cloud server 20 may be placed in a server machine room, or it may also be integrated into the single human body radiation examining device 12. Moreover, the personal identification device 11 and the data processor 30 may also be integrated into the single human body radiation examining device 12.

If there are a plurality of human body radiation examining devices 12, the cloud server

20 may be placed in a machine room, or it may also be integrated into one of the plurality of human body radiation examining devices 12 networked with one another.

As shown in Figure 2, each human body radiation examining device 12 may comprise: a radiation generator or a radiation source 120 for emitting radiations; a detector set 121
5 configured to receive the radiations and generate electrical signals, the detector set 121 may consist of a plurality of detectors arranged in an array; an image generation unit 122 configured to convert the electrical signals of the detector set into a radiation scanning image; and a dose determination unit 123 configured to extract intensity values of respective
10 pixels in a residual pixel region expect an human body image in the radiation scanning image and calculate an average value of the intensity values of the respective pixels in the residual pixel region as an average single pixel intensity value so as to determine the current radiation dose of the person according to the average single pixel intensity value.

It will be apparent to those skilled in the art that the human body radiation examining device 12 may further comprise a mechanical drive unit, an electrical-control unit, a storage
15 unit, a soft program and the like. Each human body radiation examining device 12 may have different output parameters, scanning speeds, human body radiation doses in a single scanning, conversion coefficients between the detector signals and the dose and the like, and the descriptions thereof in detail are omitted herein.

For each human body radiation examining device, a signal intensity of the detector
20 thereof will reflect an amount of the dose of the radiation received by the human body. The signal intensity of the detector is reflected as pixel intensity (brightness) in the radiation scanning image. Therefore, for a human body radiation examining device after setting-to-work test, the pixel intensity thereof is directly associated with the dose of the radiation. The higher the pixel intensity is, the larger the dose of the radiation is. For the
25 same human body radiation examining device, the scanning dose thereof should be stable for a certain parameter setting. However, the radiation scanning dose will fluctuate under effect of environment, device condition and other factors during an actual radiation examination and thus be different from the rated radiation scanning dose. However, for each radiation examining device after calibration before putting into use, a conversion coefficient
30 between the average single pixel intensity and the scanning dose without any object between the detector set and the radiation generator is constant and stored in the human body radiation examining device. Therefore, it is possible to obtain an actual scanning dose value which reflects the current actual radiation dose of the person being examined through converting with the conversion coefficient based on the average single pixel intensity value
35 in the scanning image obtained when there is no person or object between the detector set and the radiation generator.

Figure 3 is a schematic view of a radiation scanning image of a person being examined. As shown in Figure 3, the radiation scanning image includes a human body image region 51

and a residual pixel region 52 except the human body image region 51. The human body image region 51 corresponds to a region in the detector set in which the radiations are blocked by the human body (including also a region blocked by other object if there is other object). The residual pixel region 52 corresponds to a region in the detector set in which the radiations are directly irradiated on the detectors without any obstacle. Because the residual pixel region 52 and the human body are synchronously irradiated with the radiations, it is possible to obtain a radiation dose value irradiated on a human body by measuring a single pixel intensity of the residual pixel region 52 and then converting the single pixel intensity into a corresponding radiation dose value according to a conversion coefficient of the human body radiation examining device performing the current examination.

Further, since there may be errors in measurements of different detectors in the detector set, it is possible to calculate an average single pixel intensity value of the respective pixels in the residual pixel region 52 and then convert the average single pixel intensity value into the corresponding radiation dose. Because a large amount of residual pixels are used to perform an average calculation, the average value is very stable so as to correctly reflect a radiation output dose of the current scanning, thus accurately reflect the radiation dose received by the person being examined, thereby avoiding incorrect measurement of the radiation dose of the person due to a fluctuation in output of the human body radiation examining device caused by various factors.

According to other embodiments of the present invention, as shown in Figure 1, the human body radiation examining system may further comprise a personal radiation dosimeter 40. The personal radiation dosimeter 40 is configured to be carried by the person being subjected to a radiation examination so as to directly measure a single radiation dose of the person. The personal radiation dosimeter 40 may be communicated with the human body radiation examining device 12 in the wired or wireless manner to send the measured single radiation dose to the human body radiation examining device 12. Alternatively, the personal radiation dosimeter 40 may be directly communicated with the cloud server 20 to directly upload the measured single radiation dose to the cloud server. Specifically, it is possible to place the personal radiation dosimeter on the chest of the person being examined or at a position next to the person and flush with his/her chest. The personal radiation dosimeter and the person are synchronously scanned with the radiations and the personal radiation dosimeter directly measures the single radiation dose of the person.

Figure 4 is a flow chart of a method for examining a human body using the human body radiation examining system as shown in Figure 1. As illustrated in Figure 4, the method comprises steps of:

firstly registering or identifying a person when the person is ready to enter a scanning channel of the human body radiation examining device;

retrieving an accumulative radiation dose of the person, for example an annual

accumulative radiation dose, according to a personal identification result;

obtaining a predicted single radiation scanning dose of the current radiation examination if the current radiation examination is performed based on a type of the human body radiation examining device, the predicated single radiation scanning dose may be a rated radiation scanning dose of the human body radiation examining device performing the current radiation examination; and

adding the annual accumulative radiation dose of the person and the predicated single radiation scanning dose to obtain a sum value and determining whether to perform the current radiation examination on the person according to a judgment whether the sum value exceeds a dose limit.

Specifically, if the sum value exceeds a predetermined accumulative dose limit, it is determined not to perform the current radiation examination on the person so as to avoid the person from receiving excessive radiations and avoid radiation damage to health of the person. On the other hand, if the sum value obtained by adding the annual accumulative radiation dose of the person and the predicated single radiation scanning dose does not exceed the predetermined accumulative dose limit, it is determined to perform the current radiation examination on the person.

According to an example of the present invention, the accumulative radiation dose may be an accumulated value of radiation doses which have been received by a person in one year. The dose limit may be an upper limit of accumulative radiation dose which may be received by a person in one year.

When it is determined to perform the current radiation examination on the person, it is possible to monitor an output parameter of the human body radiation examining device at real time during performing the radiation examination on the person. If the output parameter is abnormal, the radiation examination is stopped. The radiation dose having been received by the person during the current partial radiation examination can be calculated by converting from a radiation dose in a complete radiation examination according to a ratio of a time period during which the current partial radiation examination is being performed to a time period during which a complete radiation examination is normally performed. The output parameter may for example be a source parameter such as a voltage, a current, a scanning speed of the radiation generator. If a source parameter exceeds its predetermined value ((abnormal)) due to a mis-operation of an operator or an equipment failure during the radiation scanning, the single radiation scanning dose may exceed the personal single radiation dose limit, which may cause health hazard to the human body. In this case, the human body radiation examining device stops emitting the radiations to interrupt the scanning operation and calculates and records the current radiation dose having been received by the person being examined. Otherwise, the human body radiation examining device will complete the current scanning and record the current radiation dose in a

complete examination.

According to an exemplary embodiment of the present invention, the above method further comprises: after performing the radiation examination on the person, obtaining a current radiation dose of the person and transmitting the information of the current radiation dose to a cloud server to update an annual accumulative value of radiation dose of the person.

Specifically, according to an exemplary embodiment of the present invention, obtaining a current radiation dose of the person comprises: obtaining a radiation scanning image of the person being examined currently; and processing the radiation scanning image to obtain the current radiation dose of the person based on an average single pixel intensity value of a residual pixel region expect a human body image region in the radiation scanning image by converting with a converting coefficient, which is stored in the human body radiation examining device in advance. The average single pixel intensity value is an average of intensity values of respective pixels in the residual pixel region expect the human body image region in the radiation scanning image.

Since there may be errors in measurements of different detectors in the detector set, it is possible to calculate an average single pixel intensity value of the respective pixels in the residual pixel region and then convert the average single pixel intensity value into the corresponding radiation dose. Because there are a large amount of residual pixels to be taken for an average calculation, the average value is very stable so as to correctly reflect a radiation output dose of the current scanning, thus accurately reflect the radiation dose of the person being scanned with radiations, thereby avoiding the radiation dose of the person from being incorrectly recorded due to a fluctuation in output dose of the human body radiation examining device caused by various factors.

According to a simplified example of the embodiment of the present invention, the radiation dose Y of the person during the current radiation examination may be calculated by the following formula:

$$Y=Y1 \cdot X/X1$$

wherein X is the average single pixel intensity value in the residual pixel region in the radiation scanning image, Y1 is a value of the rated single radiation scanning dose of the human body radiation examining device during the current human body radiation examination, X1 is a single pixel intensity value in a scanning image obtained with no person or object is scanned, corresponding to the rated single radiation scanning dose during the current human body radiation examination. X1 and Y1 may be pre-stored as equipment parameters in the human body radiation examining device.

According to another embodiment of the present invention, obtaining a current radiation dose of the person being examined comprises: obtaining the rated single radiation scanning dose of the human body radiation examining device during the current human

body radiation examination as the current radiation dose of the person.

According to a further embodiment of the present invention, obtaining a current radiation dose of the person comprises: the person carrying a personal radiation dosimeter upon being examined, and the current radiation dose of the person is measured by the personal radiation dosimeter at real time. For example, the personal radiation dosimeter may be placed on the chest of the person or at a position next to the person and flush with his/her chest. The person being examined along with the personal radiation dosimeter passes through an examining channel and the personal radiation dosimeter communicates with the human body radiation examining device in the wired or wireless manner. The personal radiation dosimeter will accurately record the radiation dose of the person during each examination.

The methods for measuring and calculating the radiation dose of the person as described above may be used separately or in combination. When using the methods in combination, the personal dose should be calculated based on the maximal value so as to protect the health of the person.

Finally, the information of the current radiation dose of the person obtained by measuring and calculating as described above is uploaded to the cloud server to be accumulated with the personal accumulative radiation dose value stored in the cloud server so as to update the accumulative radiation dose of the person.

The human body radiation examining device and method according to the above embodiments of the present invention, on one hand, can prevent the excessive single radiation dose from being generated due to the mis-operation or equipment failure. On the other hand, it is more important that the human body radiation examining device and method can monitor an accumulative radiation dose and prevent the accumulative radiation dose from going beyond the accumulative radiation dose limit, thereby improving the security for human body radiation examination.

In addition, since the actual current radiation dose of a person being examined is converted at real time according to an average single pixel intensity value, or is measured at real time by using a personal radiation dosimeter, it is possible to accurately obtain the actual current radiation dose of the person, thereby further improving the security for human body radiation examination.

In the above embodiments of the present invention, the annual accumulative radiation dose is an accumulative value of radiation doses having been received by a person in one year. The dose limit is an upper limit of an accumulative radiation dose, which is permitted to be received by a person in one year. The predicted single radiation scanning dose of the human body radiation examining device is a rated single radiation scanning dose of the human body radiation examining device. However, the above embodiments are not restrictive. For example, the accumulative radiation scanning dose may be an accumulative

value of radiation doses having received by a person in a quarter of a year. The dose limit may be an upper limit of an accumulative radiation dose, which is permitted to be received by a person in a quarter of a year. The predicted single radiation scanning dose of the human body radiation examining device may be a dose value different from the rated single
5 radiation scanning dose thereof. The human body radiation examining system of the present invention may be applicable to various fields of human body radiation examination. The radiations may include for example X-rays, γ -rays and the like, which need to be monitored for health consideration.

Therefore, the above embodiments of the present invention merely illustrate the
10 principle and configuration thereof, rather than limiting the present invention. It should be appreciated by those skilled in the art that any changes or modifications made to the embodiments of the present invention will fall within the scope of the present invention. The scope of the present invention should be solely defined by the appended claims.

What is claimed is:

1. A human body radiation examining method comprising steps of:
identifying a person to be examined;
retrieving an accumulative radiation dose of the person according to identification result;
obtaining a predicted single radiation scanning dose of a human body radiation examining device intended to perform a current radiation examination;
calculating a sum value of the accumulative radiation dose of the person and the predicted single radiation scanning dose of the human body radiation examining device; and
determining whether to perform the current radiation examination on the person according to a judgment whether the sum value exceeds a dose limit.
2. The human body radiation examining method according to claim 1, wherein the predicted single radiation scanning dose of the human body radiation examining device is a rated single radiation scanning dose of the human body radiation examining device.
3. The human body radiation examining method according to claim 1, wherein
the accumulative radiation dose is an accumulated value of radiation doses already received by the person in a year; and
the dose limit is an upper limit of an accumulated value of radiation doses permitted for the person in a year.
4. The human body radiation examining method according to claim 2, wherein determining whether to perform the current radiation examination on the person according to a judgment whether the sum value exceeds a dose limit comprises:
determining not to perform the current radiation examination on the person if the sum value of the accumulative radiation dose of the person and the rated single radiation scanning dose of the human body radiation examining device exceeds the dose limit; and
determining to perform the current radiation examination on the person if the sum value of the accumulative radiation dose of the person and the rated single radiation scanning dose of the human body radiation examining device does not exceed the dose limit.
5. The human body radiation examining method according to claim 4, further comprising:
monitoring an output parameter of the human body radiation examining device at real time during performing the radiation examination on the person and stopping the radiation examination if the output parameter is abnormal; and
calculating a radiation dose having been received by the person in the current partial

radiation examination according to a ratio of a time period during which the current partial radiation examination is performed to a time period during which an entire radiation examination is to be performed.

6. The human body radiation examining method according to claim 4, further comprising:

after performing the radiation examination on the person, obtaining a current radiation dose of the person and transmitting a datum of the current radiation dose to a cloud server to update an annual accumulative value of radiation dose of the person.

7. The human body radiation examining method according to claim 6, wherein the step of obtaining a current radiation dose of the person comprises:

obtaining a radiation scanning image of the person being examined currently; and

processing the radiation scanning image to obtain the current radiation dose of the person based on an average single pixel intensity value of a residual pixel region expect a human body image region in the radiation scanning image by converting with a converting coefficient, wherein the average single pixel intensity value is an average intensity value of respective pixels in the residual pixel region expect the human body image region in the radiation scanning image.

8. The human body radiation examining method according to claim 7, wherein the current radiation dose of the person is calculated by the following formula:

$$Y=Y1 \cdot X/X1$$

wherein X is the average single pixel intensity value in the residual pixel region in the current radiation scanning image, Y1 is a value of the rated single radiation scanning dose of the human body radiation examining device during the current human body radiation examination, X1 is a single pixel intensity value in a scanning image obtained with no person or object is scanned, corresponding to the rated single radiation scanning dose during the current human body radiation examination.

9. The human body radiation examining method according to claim 6, wherein the step of obtaining a current radiation dose of the person comprises:

obtaining the rated single radiation scanning dose of the human body radiation examining device during the current human body radiation examination as the current radiation dose of the person.

10. The human body radiation examining method according to claim 6, wherein the step of obtaining a current radiation dose of the person comprises:

the person carrying a personal radiation dosimeter upon being examined, and the current radiation dose of the person is measured by the personal radiation dosimeter at real time.

11. The human body radiation examining method according to claim 1, wherein the dose limit is variably assigned.

12. A human body radiation examining system comprising
at least one human body radiation examining device configured to examine a human body with a radiation;

a personal identification device configured to identify an identity information of a person and send the identity information to the at least one human body radiation examining device;

a cloud server configured to store a single radiation dose information of the person during each radiation examination in one year and an annual accumulative radiation dose information; and

a data processor configured to obtain a rated single radiation dose from the at least one human body radiation examining device and an annual accumulative radiation dose of the person from the cloud server and calculate a sum value of the rated single radiation dose and the annual accumulative radiation dose to determine whether to perform a current radiation examination on the person according to a judgment whether the sum value exceeds a dose limit.

13. The human body radiation examining system according to claim 12, wherein the human body radiation examining system comprises a plurality of human body radiation examining devices each communicated with the cloud server to transmit data of the single radiation dose of the person at each human body radiation examining device during each radiation examination to the cloud server and accumulate the annual radiation dose so as to establish a data base including a personal radiation dose information for each radiation examination in one year and information of the annual accumulative radiation dose.

14. The human body radiation examining system according to claim 13, wherein the plurality of human body radiation examining devices are the same or different types of human body radiation examining device.

15. The human body radiation examining system according to claim 12, wherein the dose limit is stored in the cloud server, and the dose limit is variably assigned by the cloud server.

16. The human body radiation examining system according to claim 12, wherein the data processor is integrated into each human body radiation examining device or into the cloud server.

17. The human body radiation examining system according to claim 12, wherein the personal identification device is integrated into each human body radiation examining device.

18. The human body radiation examining system according to claim 12, wherein the human body radiation examining system comprises a single human body radiation examining device, into which the personal identification device, the cloud server and the data processor are integrated.

19. The human body radiation examining system according to claim 12, further comprises a personal radiation dosimeter, the personal radiation dosimeter is carried by the person being examined for measuring the single radiation dose of the person.

20. The human body radiation examining system according to claim 12, wherein the human body radiation examining device comprises:

- a radiation generator or a radiation source for emitting radiations;
- a detector set configured to receive the radiations and generate electrical signals;
- an image generation unit configured to convert the electrical signals of the detector set into a radiation scanning image; and

- a dose determination unit configured to extract intensity values of respective pixels in a residual pixel region except a human body image in the radiation scanning image and calculate an average value of the intensity values of the respective pixels in the residual pixel region as an average single pixel intensity value so as to obtain a current radiation dose of the person by converting with a converting coefficient based on the average single pixel intensity value.