

MILLIMETER WAVE IMAGING APPARATUS,
MILLIMETER WAVE IMAGING SYSTEM, AND
PROGRAM

CROSS REFERENCE TO RELATED APPLICATION

[0001] The present international application claims the benefit of Japanese Patent Application No. 2009-284080 filed on December 15, 2009 at Japanese Patent Office, and the entire disclosure of the Japanese Patent Application No. 2009-284080 is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention is related to a millimeter wave imaging apparatus that receives millimeter waves emitted from a subject and takes an image of the subject.

BACKGROUND ART

[0003] Recently, it has been proposed to receive millimeter waves emitted from a subject such as a human body, thereby to image the subject and detect metallic/non-metallic weapons or smuggled goods hidden in the subject from the captured image (see Patent Documents 1, 2).

[0004] In this type of technique, a subject image is generated by using the circumstance, wherein signal

levels of the emitted millimeter waves are different between in the area of the human body, designated as the subject, and in the other area, so as to arrange pixels shown according to component values (such as hue, intensity, saturation and so on) obtained corresponding to the signal levels.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0005] Patent Document 1: Unexamined Japanese Patent Publication No. 2006-258496

Patent Document 2: Japanese Patent No. 2788519

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] In a millimeter wave imaging apparatus in which a subject image is generated by using a plurality of millimeter wave sensors as described above, when the temperature in the viewing area designated as the viewing target changes, the contrast between the pixels in the image cannot be appropriately maintained, and a clear image cannot to be obtained in some cases.

[0007] For example, in a case wherein the temperature in the viewing area increases, the signal levels of the millimeter waves, emitted in the form of thermal noise,

become large, thus, the detection values from the respective millimeter wave sensors similarly become large. In this case, when the temperature increases to some extent, the detection values from the respective millimeter wave sensors also become large, and the respective pixel components, determined according to these detection values, all become the maximum (or minimum) values. Therefore, the contrast between the pixels in the image cannot be maintained.

[0008] The present invention is made so as to solve such problem. The purpose of the invention is to provide a technique so as to generate a subject image in which the contrast between pixels is appropriately maintained, irrespective of the temperature change in the viewing area.

MEANS FOR SOLVING THE PROBLEM

[0009] A first aspect of the present invention for solving the above-described problem provides a millimeter wave imaging apparatus including: a lens antenna that captures millimeter waves and forms a subject image, the millimeter waves being emitted from an viewing area in regard to the viewing area, which is designated as a viewing target, and includes an emitter disposed in one portion thereof so as to emit the millimeter waves to be

designated as a reference; a millimeter wave sensor group that is constituted with more than one millimeter wave sensors, disposed in an image forming area in which the millimeter waves captured by the lens antenna form the subject image, and the millimeter wave sensors each outputs a detection value corresponding to a signal level of the millimeter wave received thereby; an image forming device that generates the subject image, formed on the basis of the detection value outputted from each of the more than one millimeter wave sensors, and by arranging pixels, each having a component corresponding to the detection value; a correction value setting device that sets a correction value for the respective millimeter wave sensors, the correction value being an error between a detection value, detected by a reference millimeter wave sensor designated among the more than one millimeter wave sensors so as to receive the millimeter waves emitted from the emitter, and a predetermined reference detection value; and a detection value correcting device that corrects the detection value detected by each of the more than one millimeter wave sensors by the correction value set by the correction value setting device, prior to formation of the subject image performed by the image forming device.

[0010] In this configuration, in order to correct respective

detection values of the more than one millimeter wave sensors, since the correction value is the error between the detection value of the reference millimeter wave sensor and the reference detection value, the correction value is added to or subtracted from the detection values so that the error is canceled out.

[0011] Moreover, "the reference detection value" in this configuration is preferably a detection value of the reference millimeter wave sensor which is set while thermal noise is sufficiently small. In this case, the detection value, obtained in a state while the contrast between pixels is appropriately maintained, becomes "the reference detection value".

[0012] Furthermore, this "reference detection value" may be a value set in advance, or alternatively be a value which is voluntarily set. For the latter case, a configuration according to a second aspect may be, for example, adopted.

[0013] The millimeter wave imaging apparatus according to a second aspect of the present invention further includes a reference setting device that sets the detection value, detected by the reference millimeter wave sensor at a predetermined timing, as the reference detection value. The correction value setting device sets the error between the detection value detected by the reference

millimeter wave sensor and the reference detection value, set by the reference setting device, as the correction value for the respective millimeter wave sensors.

[0014] "The predetermined timing" in this configuration may be at any timing. For example, timing when a user performs a specific operation, or timing when the millimeter wave imaging apparatus is started and imaging is initiated may be adopted.

[0015] Moreover, in each of the above-described configurations, the millimeter wave sensor group may be a millimeter wave sensor alley in which a plurality of the millimeter wave sensors are disposed in a matrix state. Alternatively, a millimeter wave line sensor, in which a plurality of millimeter wave sensors is disposed in one line, may be adopted.

[0016] In order to adopt the line sensor as the millimeter wave sensor group, the each of the above-described configurations may be arranged according to a third configuration (third aspect).

The millimeter wave sensor group provided in the millimeter wave imaging apparatus according to a third aspect of the present invention is constituted as a line sensor in which a plurality of millimeter wave sensors is disposed in one line in the image forming area, and which outputs the detection values for forming one line of the

subject image detected from the millimeter waves received by the millimeter wave sensors.

[0017] Moreover, the millimeter wave imaging apparatus according to the third aspect of the present invention further includes: a reflector having a reflection surface that reflects the millimeter waves captured by the lens antenna so as to guide the millimeter waves to the millimeter wave sensor group; and a reflection angle changing device that consecutively changes a reflection angle of the reflection surface and displaces the image forming area of the subject image, to be formed by the millimeter waves reflected by the reflection surface of the reflector, along a direction intersecting a direction in which the millimeter wave sensors are disposed, so that the millimeter wave sensor group sequentially outputs a set of detection values for a line of the subject image which corresponds to the reflection angle of the reflection surface, as detection values for one line of the subject image.

[0018] Every time when the set of detection values is outputted from the millimeter wave sensor group, the image forming device generates one line of the subject image, in which pixels, having parameters corresponding to the respective detection values in the set of detection values, are arranged in one line.

[0019] In addition, a fourth aspect of the present invention for solving the above-described problem provides a millimeter wave imaging system including: an emitter disposed in an area designated as a viewing target (viewing area), and emits a millimeter wave, to be designated as a reference, in one portion of the viewing area; and the millimeter wave imaging apparatus according to one of the above-described aspects.

[0020] Moreover, the emitter in this configuration may preferably be made by, as set forth in a fifth aspect of the present invention, a thermal noise source that generates thermal noise to be designated as a reference, or by a wave absorber.

Furthermore, in order to solve the above-described problem, a program that provides instructions for working as all the devices equipped in the respective configurations described above (a sixth aspect of the present invention) may be provided.

[0021] It is to be noted that the above-described program is constituted with sequences of instructions in which instructions suitable for processing by a computer system are arranged in orders, and is provided to the millimeter imaging apparatus or users thereof via various recording media or communication lines.

EFFECT OF THE INVENTION

[0022] In the millimeter wave imaging apparatus according to each of the above-described configurations, millimeter waves emitted from the emitter are received by the reference millimeter wave sensor, and the error between the detection value of this reference millimeter wave sensor and the reference detection value is designated as the correction value so as to correct the detection values of the respective millimeter wave sensors. Since the emitter is disposed in the viewing area so as to emit millimeter waves designated as the reference, if, for example, the temperature of the viewing area increases, the thermal noise emitted as the millimeter waves also becomes large, which, in turn, makes the detection value of the reference millimeter wave sensor become large.

[0023] In other words, the error between the detection value of the reference millimeter wave sensor and the reference detection value fluctuates according to the change of the temperature in the viewing area. Therefore, if the detection values of the respective millimeter wave sensors are corrected by using this error as the correction value, the influence caused by the temperature change in the viewing area can be removed from the respective detection values.

[0024] Even in a case, for example, wherein the

temperature in the viewing area increases and the pixel components, which are determined according to the detection values of the respective millimeter wave sensors, all indicate the maximum values (or the minimum values), since the error, obtained according to the temperature change, is subtracted from (or added to) these components, the components therefore indicate normal detection values.

[0025] If the subject image is generated based on the detection values corrected as above, irrespective of the temperature change in the viewing area, the contrast between the pixels can be appropriately maintained and a clear subject image can be obtained.

[0026] Moreover, in the above-described second aspect, the reference detection value designated as a reference for setting the correction value may be set at an every predetermined timing. Therefore, if the detection value of the reference millimeter wave sensor is set as the reference detection value while the temperature in the viewing area is sufficiently low, the detection value, obtained when the thermal noise emitted as the millimeter waves is small, can be set as the reference detection value.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Fig. 1 is a block diagram showing an entire structure of a millimeter wave imaging apparatus;

Fig. 2 is a block diagram showing a structure of a millimeter wave sensor constituting a line sensor;

Fig. 3 is a flowchart explaining an imaging process according to a first embodiment;

Fig. 4 is a view showing a state according to the first embodiment, wherein millimeter waves, emitted from a millimeter wave emitting portion, are reflected at a reflector;

Fig. 5 is a flowchart explaining an imaging process according to a second embodiment; and

Fig. 6 is a view showing a state according to the second embodiment, wherein millimeter waves emitted from a millimeter wave emitting portion are reflected at a reflector.

EXPLANATION OF REFERENCE NUMERALS

[0028] 1...millimeter wave imaging system, 2...millimeter wave imaging apparatus, 3...emitter, 4...millimeter wave imaging system, 5...millimeter wave imaging apparatus, 10...lens antenna, 20...millimeter wave sensor alley, 22...millimeter wave sensor, 22...reference millimeter wave sensor, 30...reflector, 32...reflection surface, 34...displacement mechanism, 50...controller,

60...millimeter wave line sensor, 100...viewing area,
102...reception antenna, 104...low noise amplifier,
108...wave detector

MODE FOR CARRYING OUT THE INVENTION

[0029] Embodiments of the present invention are described below with reference to the drawings.

(1) First Embodiment

(1-1) Entire Structure

As shown in Fig. 1, a millimeter wave imaging system 1 is constituted with a millimeter wave imaging device 2 and an emitter 3 that emits a millimeter waves in an imaging area 100 designated as an imaging target.

[0030] The millimeter wave imaging apparatus 2 includes: a lens antenna 10 that captures millimeter waves emitted from the viewing area 100, and forms an image of a subject; a millimeter wave sensor alley 20, disposed in an image forming area, wherein the millimeter waves, captured by the lens antenna 10, form the image of the subject; and a controller 50 that controls an entire operation of the millimeter wave imaging apparatus 2. It is to be noted that the millimeter wave sensor alley 20 is an example of the millimeter wave sensor group.

[0031] Among the above-described constituents, the millimeter wave sensor alley 20 is constructed in the

image forming area such that pluralities of millimeter wave sensors 22, facing an incoming direction of the millimeter waves, are respectively disposed in a matrix state along a plane, intersecting the incoming direction of the millimeter waves, and such that the millimeter wave sensors 22 respectively output detection values which correspond to signal levels of the millimeter waves that the millimeter wave sensors 22 respectively receive. The detection values, outputted from the respective millimeter wave sensors 22, become pixel information (in the present embodiment, information indicating the gray value of the pixels) regarding some portions of the subject image in the entire portion of the subject image to be formed in the image forming area which respectively correspond to the positions of the millimeter wave sensors 22.

[0032] As shown in Fig. 2, the millimeter wave sensors 22 are each constituted with: a reception antenna 102 that receives millimeter waves; a low-noise amplifier (LNA) 104 that amplifies signals received from the reception antenna 102; and a wave detector 108 that detects the signals received and amplified by the LNA 104, and detects a levels of the signals.

[0033] The emitter 3 is disposed in one portion of the viewing area 100, and emits millimeter waves, to be

designated as a reference, from where the emitter 3 is disposed toward the lens antenna 10. The millimeter waves, emitted from the emitter 3, are received by one of the millimeter wave sensors 22 predetermined in the millimeter wave sensor alley 20 (to be referred to as a "reference millimeter wave sensor").

[0034] It is to be noted that, in the present embodiment, the emitter 3 is constituted with a thermal noise source that generates thermal noise to be designated as a reference, or with a wave absorber.

(1-2) Imaging Process by Controller 50

The following describes steps of an imaging process, executed by the controller 50 according to a program stored in an internal memory, with reference to Fig. 3.

[0035] In the imaging process, first, among the millimeter wave sensors 22 of the millimeter wave sensor alley 20, the detection value of the reference millimeter wave sensor 22, that is, the detection value indicating the signal level of the millimeter wave emitted from the emitter 3, is obtained (S120). In this step, if the emitter 3 is constituted with a wave absorber, the amount of the millimeter wave emitted from the wave absorber is extremely small. Therefore, a value close to "0" is obtained here as the detection value.

[0036] Subsequently, based on the detection value obtained

in the above-described S120, a reference detection value, to be designated as a reference for calculating a correction value in a later step, is determined (S130). In this step, the detection value, obtained in the above-described s120, is determined to be the reference detection value.

[0037] Next, based on the reference detection value determined in the above-described s130, a correction value for correcting detection values is determined (s140). In this step, the error between the reference detection value r , determined in the above-described s130, and the detection value d , which has been detected at this point by the reference millimeter wave sensor, is calculated ($r-d$), and the error is determined as the correction value for the respective millimeter wave sensors 22.

[0038] When s140 is performed for the first time since the imaging process is initiated, although the error between the reference detection value, determined in the above-described s130, and the detection value, obtained in the above-described s120, is determined as the correction value, since these detection values are identical, "0" is determined to be the correction value.

[0039] Subsequently, the correction value, determined in the above-described s140, is set as the correction value

for the detection values of the respective millimeter wave sensors 22 (s150).

Then, it is determined whether or not the imaging of the subject should be continued (s170). In this step, if an instruction is externally provided to the millimeter wave imaging device 2 so as to finish the imaging (including operation by a user), it is determined that the imaging should be finished, that is, the imaging should not be continued.

[0040] In s170, if it is determined that the imaging should be continued (s170:YES), detection values detected by the millimeter wave sensors 22 provided in the millimeter wave sensor alley 20 are respectively obtained (s180).

Subsequently, the respective detection values, obtained in the above-described s180, are corrected based on the correction value which has been set at this point (s190). In this step, if the correction value, which has been set, is a positive value, the absolute value of the correction value is subtracted from the respective detection values obtained in the above-described s180. If the correction value is a negative value, the absolute value of the correction value is added to the respective detection values obtained in the above-described s180.

[0041] Next, pixel information indicated according to each

of the detection values, corrected in the above-described s190, is designated to be information of a pixel disposed corresponding to the position of the millimeter wave sensor 22 that has detected the detection value. An image of the subject is generated by arranging pixels each shown according to the pixel information (pixels having components indicated according to the pixel information) (s200). The subject image generated as above is stored in an image memory so as to be shown on a display device.

[0042] Subsequent to s200, a detection value is obtained from the reference millimeter wave sensor 22 (s210) in the same manner as in the above-described s120. Then, the process goes back to s140. In s140 in this case, the error between the detection value, obtained in s210, and the reference detection value, determined in the above-described s130, is determined to be the correction value.

[0043] Thereafter, the steps s140-s210 are repeated while it is determined that the imaging should be continued (s170:YES). When it is determined in the above-described s170 that the imaging should be finished (s170:NO), the present imaging process is over.

[0044] As described above, in the imaging process, based on the initially set detection value (reference detection

value) (s130), the differences with the detection values of the reference millimeter wave sensor are determined as the correction values so as to correct the detection values of the respective millimeter wave sensors 22 (s190), and the image of the subject is generated (s200).

(2) Second Embodiment

(2-1) Entire Structure

As shown in Fig. 4, a millimeter wave imaging system 4 according to the present embodiment is constituted with a millimeter wave imaging apparatus 5, and the emitter 3 that emits millimeter waves in the imaging area, designated as an imaging target. It is to be noted that, in the present embodiment, constituents similar to the constituents in the first embodiment are provided with the same reference numerals as in the first embodiment, and detailed description thereof is not repeated here.

[0045] The millimeter wave imaging apparatus 5 includes: the lens antenna 10; a millimeter wave line sensor 60, constituted with a plurality of millimeter wave sensors 22 disposed in one line; a reflector 30 having a reflection surface 32 that reflects millimeter waves captured by the lens antenna 10, and guides the millimeter waves to the millimeter wave line sensor 60; and the controller 50 that controls the entire operation of the millimeter wave

imaging apparatus 5. It is to be noted that the millimeter wave line sensor 60 corresponds to the millimeter wave sensor group according to the present invention.

[0046] Among these constituents, the millimeter wave line sensor 60 is constructed in the image forming area such that the pluralities of millimeter wave sensors 22, facing an incoming direction of a millimeter wave, are respectively disposed in one direction along a plane, intersecting the incoming direction of the millimeter waves, and such that the millimeter wave sensors 22 respectively output detection values which correspond to signal levels of the millimeter waves that the millimeter wave sensors 22 respectively receive.

[0047] The reflector 30 is provided with a displacement mechanism 34 that changes a reflection angle of a millimeter wave, reflected by the reflection surface 32, along a direction intersecting the direction in which the millimeter wave sensors 22 are disposed.

(2-2) Imaging Process by Controller 50

The following describes steps of an imaging process executed by the controller 50 according to a program stored in an internal memory with reference to Fig. 5.

[0048] In this imaging process, first, the reflection angle of the reflection surface 32 of the reflector 30 is changed

until an area, in which an image is formed by a millimeter wave emitted from the emitter 3, coincides with an area in which the millimeter wave sensors 22 are disposed (s110). In this step, an instruction is provided to the displacement mechanism 34 of the reflector 30 so as to change the reflection angle of the millimeter wave reflected by the reflection surface 32 to a predetermined initial angle θ' . Upon receiving this instruction, the displacement mechanism 34 changes the reflection angle of the millimeter wave reflected by the reflection surface 32 to the initial angle θ' so that the area in which an image is formed by the millimeter wave emitted from the emitter 3 coincides with the area in which the millimeter wave sensors 22 are disposed (see Fig. 6).

[0049] When the reflection angle is changed to the initial angle in the above-described s110, among the millimeter wave sensors 22 disposed in the millimeter wave line sensor 60, a detection value of the reference millimeter wave sensor, that is, a detection value indicating a signal level of the millimeter wave emitted from the emitter 3 is obtained (s120).

[0050] Subsequently, based on the detection value obtained in the above-described s120, a reference detection value, to be designated as a reference for calculating a correction value in a later step, is determined (s130).

Then, based on the reference detection value determined in the above-described s130, a correction value for correcting detection values is determined (s140), and this value is set as the correction value (s150).

[0051] Subsequently, a scan control is initiated wherein the reflection angle of the reflection surface 32 provided in the reflector 30 is repeatedly and continuously changed within a constant angle range θ " (s160). In this step, an instruction is provided to the displacement mechanism 34 of the reflector 30 so as to continuously change the reflection angle of the millimeter wave reflected by the reflection surface 32. Upon receiving this instruction, the displacement mechanism 34 starts continuously and repeatedly changing the reflection angle of the millimeter wave reflected by the reflection surface 32 within the constant angle range θ ". Therefore, scanning the viewing area 100 by the millimeter wave line sensor 60 is performed.

[0052] It is to be noted that the angle range θ " within which the reflection angle is changed in this step is set in advance, so that the image forming area in which the image of a subject is formed by the millimeter waves captured by the lens antenna 10 coincides with the area in which the millimeter wave sensors 22 are disposed.

[0053] Subsequently, it is determined whether or not the

imaging of the subject should be continued (s170). If it is determined that the imaging should be continued (s170:YES), detection values detected by the millimeter wave sensors 22 of the millimeter wave line sensor 60 are respectively obtained (s180).

[0054] Then, the detection values, obtained in the above-described s180, are respectively corrected based on the correction value which has been set at this point (s190). Pixel information indicated according to each of the corrected detection values is designated to be information of a pixel disposed corresponding to the position of the millimeter wave sensor 22 that has detected the detection value. One line of the subject image is generated by arranging pixels each shown according to pixel information (pixels having densities indicated according to the pixel information) (s200). The subject image generated as above is stored in a memory area of the image memory that stores an image of an appropriate line.

[0055] Subsequent to s200, the detection value is obtained from the reference millimeter wave sensor 22 (s210) in the same manner as in s120, and the process goes back to s140.

When it is determined in the above-described s170 that the imaging should be finished (s170:NO), the

present imaging process is over.

(3) Effects, Advantages

In the above-described millimeter wave imaging apparatuses 2, 5, millimeter waves emitted from the emitter 3 are received by the reference millimeter wave sensor 22, and the error between the detection value, detected by the reference millimeter wave sensor 22, and the reference detection value is determined as a correction value so as to correct detection values detected by the respective millimeter wave sensors (s120-s210 in Fig. 3, Fig. 5).

[0056] Since the emitter 3 is disposed in the viewing area 100 so as to emit a millimeter wave designated as a reference, if, for example, the temperature in the viewing area 100 increases, the thermal noise generated as millimeter waves becomes larger. Therefore, the detection value detected by the reference millimeter wave sensor 22 also becomes larger.

[0057] In other words, since the error between the detection value, detected by the reference millimeter wave sensor 22, and the reference detection value fluctuates corresponding to the change in the temperature of the viewing area 100, by using this error as a correction value so as to correct the detection values detected by the respective millimeter wave sensors 22,

the influence by the temperature change in the viewing area 100 can be removed from the respective detection values.

[0058] For example, in a case wherein the temperature in the viewing area 100 increases, and the components of the pixels, which are determined according to the detection values detected by the respective millimeter wave sensors 22, all indicate the maximum values (or minimum values), the error, determined corresponding to the temperature change, is subtracted from (or added to) these values. As a result, these values are corrected so as to be proper detection values.

[0059] If a subject image is generated based on the detection values corrected as above, the subject image can be clear and the contrast between the pixels is appropriately maintained, irrespective of the temperature change in the viewing area 100.

[0060] Moreover, in the above-described embodiments, the reference detection value, designated as a reference for setting the correction value, can be set every time when the image forming process is initiated (s120 in Fig. 3, Fig. 5). Therefore, if the image forming process is initiated while the temperature of the viewing area 100 is sufficiently low, the detection value, detected while thermal noise emitted as millimeter waves is small, can

be set as the reference detection value.

(4) Variation

The above has explained the embodiments according to the present invention. However, the present invention is not limited to the above-described embodiments, and may be carried out in various ways within the technical scope of the present invention.

[0061] For example, in the above-described embodiments, the configuration is such that “the reference detection value” is set in the image forming process. Alternatively, a detection value, detected in a state wherein the contrast between pixels is appropriately maintained, may be set as a fixed “reference detection value”.

[0062] Moreover, in the above-described embodiments, the configuration is such that “the reference detection value” is set immediately after the image forming process is initiated (s120 in Fig. 3, Fig. 5). However, the timing to set “the reference detection value” is not limited to this timing, but may alternatively be, for example, when a user performs a specific operation.

(5) Correspondence Relations to Present Invention

In the above-described embodiments, s200 in Fig. 3, Fig. 5 corresponds to an example of the image forming step performed by the image forming device; s140 and

s150 in these drawings respectively correspond to examples of the correction value determination step and the correction value setting step performed by the correction value setting device; s190 in these drawings corresponds to one example of the correction step performed by the detection value correction device; s120, s130 in these drawings respectively correspond to examples of the detection value obtaining step and the reference detection value determining step performed by the reference setting device; and s110, s160 in Fig. 5 correspond to one example of the reflection angle changing step performed by the reflection angle changing device.

CLAIMS

1. A millimeter wave imaging apparatus comprising:

a lens antenna that captures millimeter waves and forms a subject image, the millimeter waves being emitted from an viewing area in regard to the viewing area, which is designated as a viewing target, and includes an emitter disposed in one portion thereof so as to emit the millimeter waves to be designated as a reference;

a millimeter wave sensor group that is constituted with more than one millimeter wave sensors, disposed in an image forming area in which the millimeter wave captured by the lens antenna forms the subject image, and the millimeter wave sensors each outputs a detection value corresponding to a signal level of the millimeter wave received thereby;

an image forming device that generates the subject image, formed on the basis of the detection value outputted from each of the more than one millimeter wave sensors, and by arranging pixels, each having a component corresponding to the detection value;

a correction value setting device that sets a correction value for the respective millimeter wave sensors, the correction value being an error between a detection value, detected by a reference millimeter wave sensor designated among the more

than one millimeter wave sensors so as to receive the millimeter wave emitted from the emitter, and a predetermined reference detection value; and

a detection value correcting device that corrects the detection value detected by each of the more than one millimeter wave sensors by the correction value set by the correction value setting device, prior to formation of the subject image performed by the image forming device.

2. The millimeter wave imaging apparatus according to claim 1 further comprising a reference setting device that sets the detection value, detected by the reference millimeter wave sensor at a predetermined timing, as the reference detection value,

wherein the correction value setting device sets the error between the detection value detected by the reference millimeter wave sensor and the reference detection value, set by the reference setting device, as the correction value for the respective millimeter wave sensors.

3. The millimeter wave imaging apparatus according to claim 1 or claim 2,

wherein the millimeter wave sensor group is constituted as a line sensor in which a plurality of millimeter wave sensors is disposed in one line in the image forming area, and which

outputs the detection values for forming one line of the subject image detected from the millimeter wave received by the millimeter wave sensors,

the millimeter wave imaging apparatus further comprising:

a reflector having a reflection surface that reflects the millimeter waves captured by the lens antenna so as to guide the millimeter waves to the millimeter wave sensor group; and

a reflection angle changing device that consecutively changes a reflection angle of the reflection surface and displaces the image forming area of the subject image, to be formed by the millimeter waves reflected by the reflection surface of the reflector, along a direction intersecting a direction in which the millimeter wave sensors are disposed, so that the millimeter wave sensor group sequentially outputs a set of detection values for a line of the subject image which corresponds to the reflection angle of the reflection surface, as detection values for one line of the subject image,

wherein, every time when the set of detection values is outputted from the millimeter wave sensor group, the image forming device generates one line of the subject image, in which pixels, having parameters corresponding to the respective detection values in the set of detection values, are arranged in one line.

4. A millimeter wave imaging system comprising:

an emitter disposed in an area designated as a viewing target (viewing area), and emits millimeter waves, to be designated as a reference, in one portion of the viewing area; and

the millimeter wave imaging apparatus according to one of claims 1 to 3.

5. The millimeter wave imaging system according to claim 4, wherein the emitter is made by a thermal noise source that generates thermal noise to be designated as a reference, or by a wave absorber.

6. A program that makes a computer work as all the devices according to one of the claims 1 to 3.