Bibliographic Data

Int.Cl.	G06K 9/00 | G06F 3/01 | G06K 9/62 | G06T 7/20 | G06T 7/00 | G06K 9/48
Published Date	20170719
Registration No.	1017541260000
Registration Date	20170629
Application No.	1020160072357
Application Date	20160610
Priority Claims	62/173,417 | 20150610 | US
Requested Date of Examination	20160610
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Title of Invention

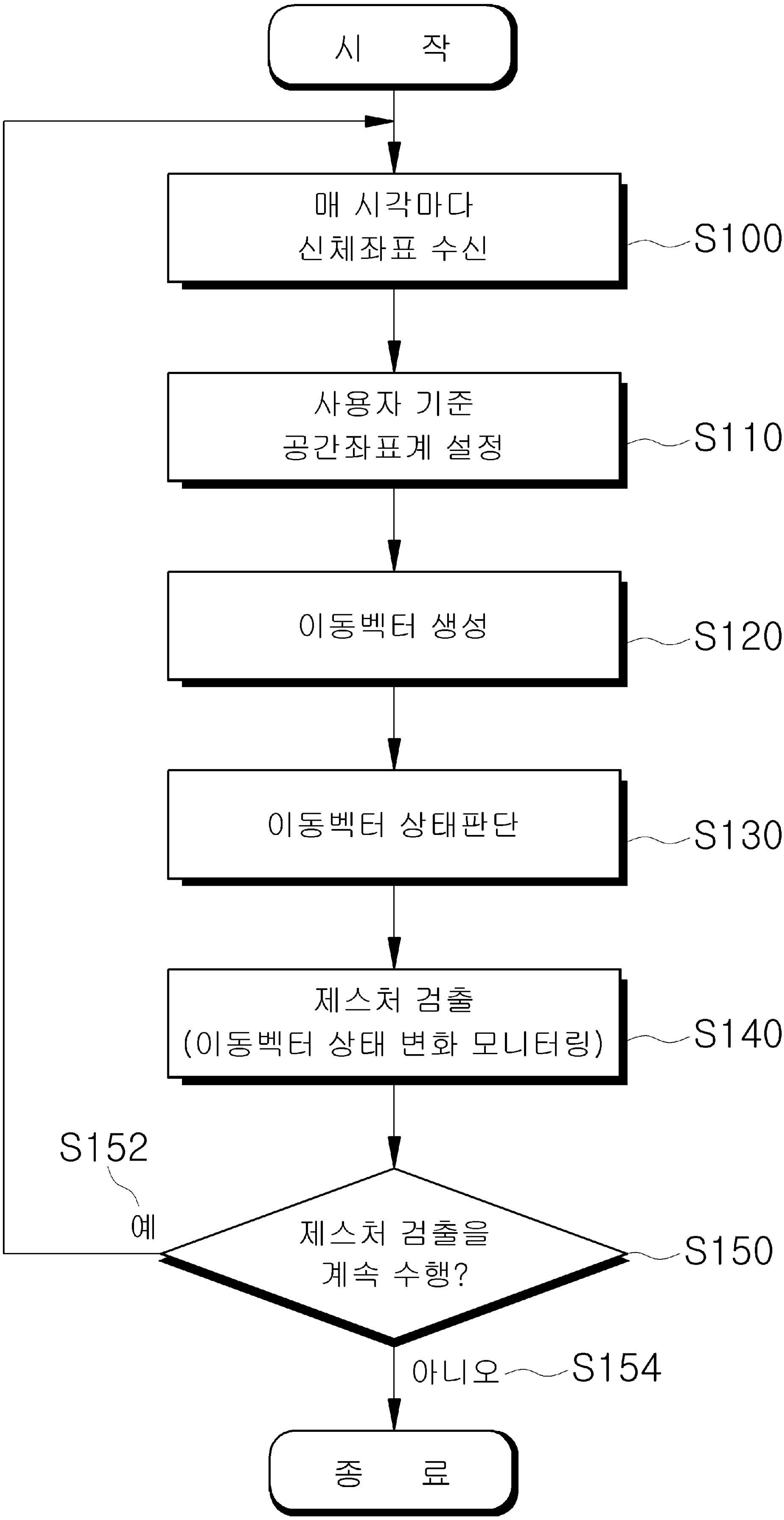
GESTURE DETECTION METHOD AND APPARATUS ON USER-ORIENTED SPATIAL COORDINATE SYSTEM

Abstract

A method and apparatus for accurately detecting the gesture using the spatial coordinate system which does based on the user from the motion of the user are disclosed.

The step that the gesture detection method on the user standard spatial coordinate system according to one side of the invention sets up the user standard spatial coordinate system having the first body coordinate corresponding to the first body part of the user as the origin, the step of analyzing the state of the motion vector according to the time of the second body coordinate corresponding to the second body part of the user on the user standard spatial coordinate system, and the step of detecting the gesture of the user based on the change of the state of the motion vector are included.

대표도면(Representative drawing)



Scope of Claims

Claim 1:

A gesture detection method on the user standard spatial coordinate system comprising the steps of: including the step of setting up the user standard spatial coordinate system having the first body coordinate corresponding to the first body part of the user as the origin, the step of analyzing the state of the motion vector according to the time of the second body coordinate correspon ding to the second body part of the user on user standard spatial coordinate system, and the step of detecting the gesture of the user based on the change of the state of

motion vector; including

user standard spatial coordinate system, is the antero-posterior axis, and the left-right axis and top-and-bottom axis; and further including the step of producing the antero-posterior axis so that the step of setting up

user standard spatial coordinate system passes by the first body coordinate and the second body coordinate.

Claim 2:

Deletion.

Claim 2:

Deletion.

Claim 3:

As for claim 1, the gesture detection method further including the step on the user standard spatial coordinate system wherein the step of setting up

user standard spatial coordinate system produces the antero-posterior axis, the left-right axis and top-and-bottom axis it is orthogonal to the respectively the step :

and the first body coordinate are passed by that produce the antero-posterior axis and left-right axis it is parallel to the surface it is orthogonal the first body coordinate is passed by.

Claim 4:

As for claim 1, the gesture detection method it passes by the step :

and the first body coordinate ; and further including the step of producing the left-right axis with the antero-posterior axis and top-and-bottom axis in order to be orthogonal to the respectively. On the user standard spatial coordinate system wherein the step of setting up

user standard spatial coordinate system produces the antero-posterior axis and top-and-bottom axis in the first body coordinate it is orthogonal it is orthogonal to the straight line that connect the third body coordinate corresponding to the first body coordinate and the third body part in the first body coordinate the first body coordinate is passed by.

Claim 5:

As for claim 1, the gesture detection method on the user standard spatial coordinate system wherein the step of analyzing the state of

motion vector further includes the step that produces in order to have the Spherical coordinate of

the motion vector (**V**) about the second body coordinate (x_2,y_2,z_2), of the second body coordinate (x_1,y_1,z_1) of the first perspective of

second body part and deuteroscopy.

Claim 6:

As for claim 5, the gesture detection method on the user standard spatial coordinate system wherein the step of analyzing the state of

motion vector further includes the step that specify to any one of stationary state, the forward condition, and the backward state and surface migration state the r of

motion vector, and the state of the motion vector based on θ and φ.

Claim 7:

The gesture detection method on the user standard spatial coordinate system of claim 6, wherein the step of detecting the gesture of

user further includes the step the state of

motion vector changes into the stationary state in the forward condition ; and of the touch gesture being generated and determining.

Claim 8:

The gesture detection method on the user standard spatial coordinate system of claim 6, wherein the step of detecting the gesture of

user further includes the step the state of

motion vector changes into the backward state ; and of the release gesture being generated and determining.

Claim 9:

The gesture detection method on the user standard spatial coordinate system of claim 6, wherein the step of detecting the gesture of

user further includes the step the state of

motion vector changes into the backward state in the forward condition after the stationary state ; the state changes in the forward condition into the backward state ; and of the click gesture being generated and determining.

Claim 10:

The gesture detection method on the user standard spatial coordinate system of claim 6, wherein the step of detecting the gesture of

user further includes the step the state of

motion vector changes into the surface migration state ; and of the dragging gesture confronted on the surface of the virtual spherical surface being generated and determining.

Claim 11:

The gesture detection method on the user standard spatial coordinate system of claim 6, wherein the step of detecting the gesture of

user further includes the step that the hold gesture is generated in case the maintain and the state of

motion vector determines the stationary state.

Claim 12:

The gesture detection method on the user standard spatial coordinate system of claim 6, wherein the step of detecting the gesture of

user further includes the step the state of

motion vector changes into the order of the forward condition - stationary state - forward condition - stationary state ; and of the dip touch (deep touch) gesture being generated and determining.

Claim 13:

The gesture detection apparatus it produces the motion vector of the second body coordinate according to the user standard spatial coordinate system setting unit :

time producing the user standard spatial coordinate system having the first body coordinate corresponding to the first body part as the origin from the external 3D body coordinate detecting measure based on the body coordinate of 3D body coordinate receiving unit:

plurality receiving multiple body coordinates corresponding to multiple body parts including the first body part and the second body part of the user ; it includes the gesture detection part detecting the gesture of the user based on the change of the state of the motion vector analysis section :

of judging the state of the motion vector and motion vector ; and further including the antero-posterior axis setting unit in which

user standard spatial coordinate system setting unit sets up the antero-posterior axis of the user standard spatial coordinate system in order to pass by the first body coordinate and the second body coordinate. On the user standard spatial coordinate system.

Claim 14:

Deletion.

Claim 14:

Deletion.

Claim 15:

As for claim 13, the gesture detection apparatus further including the top-and-bottom axis setting unit producing the top-and-bottom axis on the user standard spatial coordinate system wherein

user standard spatial coordinate system setting unit passes by ; and the respectively is orthogonal to the antero-posterior axis and left-right axis the left-right axis setting unit :

and the first body coordinate that produce the left-right axis it is parallel to the surface

first body coordinate is passed by ; and it is orthogonal to the antero-posterior axis.

Claim 16:

As for claim 13, the gesture detection apparatus it passes by the top-and-bottom axis setting unit :

and the first body coordinate ; and further including the left-right axis setting unit which produces the left-right axis with the antero-posterior axis and top-and-bottom axis in order to be orthogonal to the respectively. On the user standard spatial coordinate system wherein

user standard spatial coordinate system setting unit produces the top-and-bottom axis it is orthogonal to the antero-posterior axis in the first body coordinate it is orthogonal to the straight line that connects the third body coordinate corresponding to the first body coordinate and the third body part in the first body coordinate the first body coordinate is passed by.

Claim 17:

As for claim 13, the gesture detection apparatus on the user standard spatial coordinate system wherein

motion vector analysis section further includes the motion vector generating unit that produces in order to have the Spherical coordinate of

the motion vector (**V**) about the second body coordinate (x_2,y_2,z_2), of the second body coordinate (x_1,y_1,z_1) of the first perspective of

second body part and deuteroscopy.

Claim 18:

As for claim 17, the gesture detection apparatus on the user standard spatial coordinate system wherein

motion vector analysis section further includes the motion vector state judgment part that specify to any one of stationary state, the forward condition, and the backward state and surface migration state the r of

motion vector, and the state of the motion vector based on θ and φ.

Claim 19:

As for claim 18, the gesture detection apparatus further including the gesture determining unit determining the type of the gesture of the user on the user standard spatial coordinate system wherein

gesture detection part is corresponded to the change of the state of the motion vector based on the gesture storage :

of storing and gesture storage the type of the gesture corresponded to the type at the change type of the state of the motion vector monitoring unit :

and motion vector that monitors the change of the state of the motion vector.

Technical Field

The invention relates to the gesture detection method on the user standard spatial coordinate system, and more specifically, to geometric arrangement (the position and direction) between the user toward 3D coordinate detecting measure (it for example says to be hereinafter the "3 dimension coordinate detecting measure " this with 3D camera etc) of the body of user and method and apparatus for has nothing to do accurately detecting the gesture using the spatial coordinate system which does based on the user from the motion of the user.

Background Art

The gesture through the movement (motion) of the body part can be performed through 3D coordinate detecting measure. For example, in the outside including 3D camera (ToF, structured Light, Stereo, Dual Aperture) among 3D coordinate detecting measure, the Radar, the Lidar etc, it is the mode detecting the position of the body coordinate of the user. 3D coordinate of the body can be detected from the sensor which the GPS (Global Positioning System), the IPS (Indoor Positioning System), the RSSI (Received Signal Strength Indication), the gyro sensor, the acceleration sensor, the user including the magnetic field sensor etc put.

But the disadvantage that it misacknowledged the motion of the user or the user was unable to recognize according to the case of performing the motion in the direction which accurately did not face 3D coordinate detecting measure, and the position or the direction of the user had the conventional gesture recognition technology. Especially, it had the disadvantage geometric arrangement (the position and direction) between the user and 3D coordinate detecting measure were changed whenever it performed the gesture to each group and had to control the instrument of the some part to the single 3D coordinate detecting measure of unable to recognizing the motion of the user as the right gesture.

Figure 1 is drawing showing the problem of the conventional gesture recognition technology.

In fig. 1, the case where it accurately does not face 3D coordinate detecting measure (10) and the user (11) moves finger in the oblique direction to the side (103) of the frist position (101) is exemplified. With advance or the lagging behind of finger is meant the space vector (105) in which the conventional gesture recognition technology shows this kind of the movement can be recognized to the intention of the user in the wrong way. Or there is a problem that it recognizes according to the intention of the user. And yet the correct recognition rate markedly drops.

Therefore, the technology which had no concern with geometric arrangement between 3D coordinate detecting measure and user accurately detected the gesture from the motion of the user was requested.

Summary of Invention

Problem to be solved

The object of the invention is to provide a method and apparatus for meets and is taken notice. Accurately detecting the gesture using the spatial coordinate system which does based on the user from the motion of the user in the above-mentioned request.

Means to solve the problem

The step that the gesture detection method on the user standard spatial coordinate system according to one side of the invention sets up the user standard spatial coordinate system having the first body coordinate corresponding to the first body part of the user as the origin, the step of analyzing the state of the motion vector according to the time of the second body coordinate corresponding to the second body part of the user on the user standard spatial coordinate system, and the step of detecting the gesture of the user based on the change of the state of the motion vector are included.

Then, it may further include the step of producing the antero-posterior axis in order to pass by the first body coordinate and the second body coordinate.

Moreover, the step of setting up the user standard spatial coordinate system passes by the first body coordinate and it is orthogonal to the antero-posterior axis and the surface, the step of producing the left-right axis in order to be parallel to and the first body coordinate are passed by and the step of producing the top-and-bottom axis with the antero-posterior axis and left-right axis in order to be orthogonal to the respectively is further include might.

Moreover, the step of setting up the user standard spatial coordinate system passes by the first body coordinate and it is orthogonal to the straight line connecting the third body coordinate corresponding to the first body coordinate and the third body part in the first body coordinate and the step of producing the top-and-bottom axis in the first body coordinate with the antero-posterior axis in order to be orthogonal and the first body coordinate are passed by and the step of producing the left-right axis with the antero-posterior axis and top-and-bottom axis in order to be orthogonal to the respectively is further include might.

Moreover, the step, of analyzing the state of the motion vector is the motion vector (**V**) about the second body coordinate (x(sub)2(/sub),y(sub)2(/sub),z(sub)2(/sub)), of the second body coordinate (x(sub)1(/sub),y(sub)1(/sub),z(sub)1(/sub)) of the first perspective of the second body part and deuteroscopy

The step of producing in order to have the Spherical coordinate is further include might.

Furthermore, the step of specifying to any one of step, of analyzing the state of the motion vector is the r of the motion vector, the stationary state the state of the motion vector based on θ and φ, the forward condition, and the backward state and surface migration state is further include might.

Moreover, in case as to the step, of detecting the gesture of the user the state of the motion vector changes into the stationary state in the forward condition the step of the touch gesture being generated and determining is further include might.

Moreover, in case as to the step, of detecting the gesture of the user the state of the motion vector changes into the backward state the step of the release gesture being generated and determining is further include might.

Moreover, as to the step, of detecting the gesture of the user the state of the motion vector changes into the backward state in the forward condition after the stationary state or in case the state changes in the forward condition into the backward state the step of the click gesture being generated and determining is further include might.

Moreover, the step of detecting the gesture of the user may further include the step that the drag gesture confronted on the surface of the virtual spherical surface is generated in case the maintain and the state of the motion vector determines the surface migration state. Moreover, the hold gesture is generated in case the maintain and as to the step, of detecting the gesture of the user the state of the motion vector can determine the stationary state.

Moreover, in case as to the step, of detecting the gesture of the user the state of the motion vector changes into the order of the forward condition - stationary state - forward condition - stationary state the step of the dip touch (deep touch) gesture being generated and determining is further include might.

The gesture detection apparatus on the user standard spatial coordinate system according to the dissimilar side of the invention comprises 3D body coordinate receiving unit receiving multiple body coordinates corresponding to multiple body parts including the first body part and the second body part of the user from the external 3D body coordinate detecting measure; the user standard spatial coordinate system setting unit producing the user standard spatial coordinate system having the first body coordinate corresponding to the first body part as the origin based on multiple body coordinates; the motion vector analysis section which produces the motion vector of the second body coordinate according to time and judges the state of the motion vector; and the gesture detection part detecting the gesture of the user based on the change of the state of the motion vector.

Then, the user standard spatial coordinate system setting unit may further include the antero-posterior axis setting unit which sets up the antero-posterior axis of the user standard spatial coordinate system in order to pass by the first body coordinate and the second body coordinate.

Moreover, the user standard spatial coordinate system setting unit passes by the first body coordinate and it is orthogonal to the antero-posterior axis and it passes by the left-right axis setting unit: which produces the left-right axis with the surface in order to be parallel to and the first body coordinate and it may further include the top-and-bottom axis setting unit producing the top-and-bottom axis which is respectively orthogonal with the antero-posterior axis and left-right axis.

Or the user standard spatial coordinate system setting unit passes by the first body coordinate and it is orthogonal to the straight line connecting the third body coordinate corresponding to the first body coordinate and the third body part in the first body coordinate and it passes by the antero-posterior axis, the top-and-bottom axis setting unit: which produces the top-and-bottom axis in order to be orthogonal, and the first body coordinate in the first body coordinate and it may further include the antero-posterior axis, the top-and-bottom axis and the left-right axis setting unit which produces the left-right axis in order to be orthogonal to the respectively.

Moreover, the motion vector analysis section, is the motion vector (**V**) about the second body coordinate (x(sub)2(/sub),y(sub)2(/sub),z(sub)2(/sub)), of the second body coordinate (x(sub)1(/sub),y(sub)1(/sub),z(sub)1(/sub)) of the first perspective of the second body part and deuteroscopy

The motion vector generating unit which it produces in order to have the Spherical coordinate, is further include might.

Moreover, the motion vector state judgment part which specify to any one of motion vector analysis section, is the r of the motion vector, the stationary state the state of the motion vector based on θ and φ, the forward condition, and the backward state and surface migration state is further include might.

Moreover, it may further include the motion vector monitoring unit:, monitoring the change of the state of the motion vector the gesture storage: storing the type of the gesture corresponded to the type at the change type of the state of the motion vector and the gesture determining unit determining the type of the gesture of the user corresponded to the change of the state of the motion vector based on the gesture storage.

Effects of the Invention

It has the effect that the invention a method and apparatus for if uses , has no concern with geometric arrangement (the position and direction) which 3D coordinate detecting measure - user go accurately detecting the gesture using the spatial coordinate system which does based on the user from the motion of the user can be implemented.

Description of Embodiments

Hereinafter, referring to the figure, more specifically, the description of the invention is illustrated.

Figure 2 is a drawing showing an example of the user standard spatial coordinate system.

As shown in it exemplifies in fig. 2 the invention forms the spatial coordinate system based on the user. The spatial coordinate system is formed based on the user. In that way it has no concern with the geometric arrangement which the camera and user goes the motion of the user can be interpreted according to the intention of the user.

In the user standard spatial coordinate system, the straight line continuing the coordinate of the coordinate of the first body part of the user and the second body part is set up as the " antero-posterior axis " in advance.

In the specification whole, the origin of the user standard spatial coordinate system becomes the coordinate of the first body part. The first body part can choose one side eye of for example, the binocular of the user. But if it can function to the origin of the user standard spatial coordinate system although it is any body part it can be designated for the first body part. Moreover, the body part in which motion is made becomes the second body part. The gesture is detected from the motion of the second body part. The second body part can choose for example, the specific finger-tip or the pen tip which the user grips with hand of the user. But according to the flow of time, if motion is made although it is any body part or the object lice gripped with the body part it can be designated for the second body part.

Next, in the first body part, the " left-right axis " and " top-and-bottom axis " are set up on plane orthogonal to the antero-posterior axis. If the left-right axis is set up in advance , the top-and-bottom axis is determined as the shaft which is respectively orthogonal in the antero-posterior axis and left-right axis. In some cases, the top-and-bottom axis is set up in advance and the left-right axis is determined as the shaft which is respectively orthogonal in the antero-posterior axis and top-and-bottom axis.

The left-right axis means the shaft which the user horizontally recognizes. The space of the user is divided with the left-right axis to the left side and right side.

Moreover, the top-and-bottom axis means the shaft which the user perpendicularly recognizes. The space of the user is divided with the top-and-bottom axis to the upper direction and downward.

Moreover, the antero-posterior axis means the shaft which the user recognizes as forward and backward. The space of the user is rearwards divided with the antero-posterior axis with front.

Moreover, in the left-right axis, and the top-and-bottom axis and antero-posterior axis is the inscription manner of the general spatial coordinate system, it can correspond in the x-axis, and the y-axis and z shaft.

Fig. 3 is the force shaft of the user standard spatial coordinate system of 2 the x-axis, and the y-axis and drawing corresponded in the z shaft.

As shown in the left-right axis (21) of fig. 2 is 3, it can correspond in the x-axis (31). For example, in the direction of the amount (+) of the x-axis (31) is the user standard spatial coordinate system, it comes under the " right side " of the user.

The top-and-bottom axis (22) can correspond in the y-axis (32). For example, in the direction of the amount (+) of the y-axis (32) is the user standard spatial coordinate system, it comes under the " upper direction " of the user. The antero-posterior axis (20) can correspond in the z shaft (30). For example, in the direction of the amount (+) of the z shaft (30) is the user standard spatial coordinate system, it comes under the " rearward " of the user.

Figure 4 is a drawing showing an example of the method for setting up the top-and-bottom axis and left-right axis of the user standard spatial coordinate system.

The left-right axis the user standard spatial coordinate system exemplified in fig. 4 is orthogonal to the antero-posterior axis and gravity direction and the top-and-bottom axis is set up with the antero-posterior axis and left-right axis in order to be orthogonal. It is the case where the user stands in the level ground. If it is the case (1) first body part (400) is passed and it perpendiculars with (2) gravity direction and it can be conformed the direction of the left-right axis and left and right which the user recognizes by setting up the left-right axis in (3) antero-posterior axis and the first body part (400) in advance in order to be orthogonal. Similarly, (1) first body part (400) is passed and it is parallel to (2) surface of the earth and it can be conformed the direction of the left-right axis and left and right which the user recognizes by setting up the left-right axis in (3) antero-posterior axis and the first body part (400) in order to be orthogonal.

In the top-and-bottom axis is the origin (400), it is determined as the straight line which is respectively orthogonal in the left-right axis and antero-posterior axis.

Figure 5 is a drawing showing the dissimilar example of the method for setting up the top-and-bottom axis and left-right axis of the user standard spatial coordinate system.

It is the case where the user stands in the inclined surface. If it is the case the vertical axial direction which the gravity direction and user recognize does not coincide with.

Therefore, the case where the user stands in the inclined surface is compared and (1) first body part (500) is passed and it is parallel to (2) surface of the earth and it can be conformed the direction of the left-right axis and left and right which the user recognizes by setting up the left-right axis in advance in order to be parallel to the surface of the earth (53). By setting up the left-right axis in (3) antero-posterior axis and the first body part (500) in order to be orthogonal.

In this case, in the top-and-bottom axis is the origin (500), it is determined as the straight line which is respectively orthogonal in the left-right axis and antero-posterior axis.

Figure 6 is a drawing showing another example of the method for setting up the top-and-bottom axis and left-right axis of the user standard spatial coordinate system.

It is not direction of right and left which the user recognizes if the head of the user inclines the surface of the earth and the parallel direction.

In order that the head of the user inclines the left-right axis and the top-and-bottom axis which the user recognizes do not change it has no concern as the right eye or the left eye if it is the eye of one side made it as the standard among both banks of (1) first body part (for example, the left eye) (user. Furthermore, the derision inside among both banks of the user can be used as the first body part. Hereinafter, the body part in which it is the same in this specification whole it passes (600) and it becomes the first body part (, in other words, the origin of the user standar d spatial coordinate system in (2) first body part (600). For example, it is orthogonal to the wire extend (63) of the third body part (for example, the right eye) (604) and left eye) (600) and in order that it is orthogonal to the antero-posterior axis (60) in (3) first body part (600) the top-and-bottom axis (62) is set up.

In the left-right axis (61) is the origin (600), it is determined as the straight line which is respectively orthogonal in the antero-posterior axis (60) and top-and-bottom axis (62).

It is drawing in which fig. 7 exemplifies the motion vector at the user standard spatial coordinate system.

It is the vector showing motion between the second body part (704) at the deuteroscopy in which the motion vector (700) follows the second body part (702) at the first perspective of the user and the first perspective around. In order to more comply with for the intention of the user by interpreting the motion vector according to time in the user standard spatial coordinate system th e meaning of the gesture of the user can be grasped on.

Then, as shown in the left-right axis of the user standard spatial coordinate system, and the top-and-bottom axis and antero-posterior axis is drawing, it indicates by the x-axis of the cartesian coordinate system, and the y-axis and z shaft. (in the meantime, the direction of the amount of the z shaft is behind corresponded of the user)

In the lower part is 8 after, more specifically, the method for detecting the gesture through the interpretation of the motion vector is illustrated.

It is drawing in which fig. 8 expresses the motion vector of 7 in the Spherical coordinate.

The motion vector which the inventor exemplified in fig. 7 was expressed in the Spherical coordinate in the user standard spatial coordinate system. In that way it discovered very easily interpr eting the meaning of the gesture based on the motion vector.

In the user standard spatial coordinate system the coordinate of the second body part (702) at the first perspective of the user in fig. 7, the coordinate of the second body part (704) at the deu teroscopy decides to be shown in terms of (x(sub)1(/sub),y(sub)1(/sub),z(sub)1(/sub)) in (x(sub)2(/sub),y(sub)2(/sub),z(sub)2(/sub)).

Then, in the first perspective, the motion vector showing the movement of the second body part of the user for time to the deuteroscopy can be expressed as **V =** (r, θ, φ).

In the r is the first perspective, the translation distance of the second body part of the user is shown for time to the deuteroscopy. The angle in which it is comprised of the direction of the amo unt of the antero-posterior axis is meant. The angle in which the motion vector which φ projects on the x-y plane is comprised of the direction of the amount of the left-right axis is meant. (0° ≤ φ ≤ 360°, 0°≤ θ ≤ 180°)

Moreover, the motion vector **V** can show like the lower part equation 1.

[Equation 1]

The table 1 is the direction and the table showing the relation of the size of φ of the motion vector.

Figure 9 is a drawing showing the relation of the direction of the size of θ component of the motion vector comprised of the z shaft and motion vector.

Figure 10 is a drawing showing the relation of the direction of the size of φ component of the motion vector comprised of the x-axis and motion vector.

In the table 1, and the example of figures 9 and 10, the moving direction of the motion vector is defined as 6 kinds of the front (Forward), the rearward (Backward), left side (Left), right side, t he upper direction (Upward), the downward. That is, in the table 1, the other moving direction decides to omit for the simplification of the description.

Moving direction	**θ**	**Φ**
Total	135°~180°	-
After	0°~45°	-
Left	45°~135°	135°~225°
Right	45°~135°	315°~45°
Phase	45°~135°	45°~135°
	45°~135°	225°~315°

The body cannot be moved so that the user elects or the perfect circle is drawn. The intention of the user moved the finger-tip to the left side. And yet it is exact in fact it does not move to the left side but it is a little bit perverse the user will move. Therefore, the some error need to be considered in order to translate the motion of the user.

<u>The domain (900) in which the range is 0°≤ θ ≤ 45° is defined as the rearward in consideration of such error. In this range, it has no concern with the value of φ the motion vector (in other wo rds, the user finger end) is the back movement interpreted as one.</u>

Similarly, the domain (920) in which the range is 135°≤ θ ≤ 180° is defined as front. In this range, it has no concern with the value of φ the motion vector (in other words, the user finger end) interprets the forward movement as one.

The domain (910) in which the range is 45°003c# θ 003c# 135° front is defined as the surface migration which is not rearward. Therefore, according to the range of θ is 45°003c# θ 003c# 13 5° rear side, and the range of φ, the domain (1010) in which the domain (1000) in which the domain (1030) which is 135°≤ φ ≤ 225° 315°≤ φ or the domain (1020) which is φ ≤45° is 45°≤ φ ≤ 135° to the left side to the right side is 225°≤ φ ≤ 315° to the upper direction is defined as the downward.

That is, the range is in the domain (910). The range of φ the domain (1000), the domain (1010) , and the domain (1020) or the motion vector classified into the domain (1030) interprets the u pper direction, the downward, and the right side or the left movement as one.

It is the vote which more subdivides the direction of the motion vector and in which the table 2 exemplifies the relation with the size of φ.

In the table 1, the direction of the motion vector was defined as 6 kinds. But it can be insufficient to 6 kinds direction because of defining the movement of the finger-tip. Therefore, in the table 2, the direction of the motion vector was subdivided into 18 kinds and it defined.

Moving direction	**θ**	**Φ**
Total	50°~180°	-
Translocation	120°~150°	135°~225°
Fellow soldier	120°~150°	315°~45°
Phase inversion	120°~150°	45°~135°
Electric charge	120°~150°	225°~315°
Left	60°~120°	155°~205°
Left and top	60°~120°	115°~155°
Phase	60°~120°	65°~115°
Top right	60°~120°	25°~65°
Right	60°~120°	335°~25°
Bottom right	60°~120°	295°~335°
	60°~120°	245°~295°
Lower left	60°~120°	205°~245°
After left	30°~60°	135°~225°
	30°~60°	315°~45°
Afterimage	30°~60°	45°~135°
After	30°~60°	225°~315°
After	0°~30°	-

As shown in table 2, according to the relation of the size of θ of the motion vector for the time (t(sub)2-(/sub)t(sub)1(/sub)) and φ, the moving direction of the motion vector can be determine d.

For example, it was 130° and φ was 1°. It can determine because the user finger end moved for the time (t(sub)2-(/sub)t(sub)1(/sub)) the front right (Forward-Right).

Figure 11 is a phase diagram (state diagram) showing the transferability status of the motion vector.

In the before is 7, as described above, the motion vector is defined as displacement between the specific time interval. For example, it is defined as the displacement price motion vector of the finger-tip per the unit time.

As shown in Figure 11, the kinematic state of the motion vector can classify according to four kinds state.

The motion vector the first state (S0) is the stopping state. For example, actually the user finger end of the stopping state corresponds to the state (S0) for the unit time.

The second state (S1) is the state where the motion vector moves forwardly. For example, the body part in which the first body part (, which is the standard body part in other words, the origi n of the user standard spatial coordinate system becomes the finger-tip the user for the unit time. For example, the motion moved to the direction (in other words, front) which becomes distan t from the left eye) is applicable to the state (S1).

The third state (S2) is the state where the motion vector moves backward. For example, the body part in which the first body part (, which is the standard body part in other words, the origin of the user standard spatial coordinate system becomes the finger-tip the user for the unit time. For example, the motion moved to the direction (in other words, the rearward) drawing to the l eft eye) is applicable to the state (S2).

Four the state (S3) is the state where the motion vector moves through surface. For example, the body part in which the first body part (, which is the standard body part in other words, the o rigin of the user standard spatial coordinate system becomes the finger-tip the user for the unit time. For example, the motion moved in the distance which does not become distant that mayb e the distance becomes intimate on the left eye) is applicable to the state (S3). Moreover, the altogether up and down/left and right motion correspond to the state (S3).

More specifically, four kinds state is illustrated.

The body part in which the first body part (of the user, in other words, the origin of the user standard spatial coordinate system consists of the time interval when the apparatus for detecting t he gesture of the user is determined at each time. For example, the left eye) and the second body part (, in other words, the subjected body part of the gesture detection in the user standard s patial coordinate system. For example, 3D coordinate information of the specific finger-tip) is received and the motion vector **V =** (r, θ, φ) of the second body part is saved at each time.

For example, 3D camera of the ToF mode detects the first body part, and the second body part 3D image acquired to the mode measuring the time to light be reflected and come around at the constant time interval at 1 frame-by-frame storage, and stored each image frame and 3D coordinate for the second body part and the first body part is produced.

Or 3D image acquired using the parallax (Disparity) of two images input to 3D camera of the Stereo Camera mode from the left and right image sensor the first body part, and the second body part is detected at the constant time interval at 1 frame-by-frame storage, and stored each image frame and 3D coordinate for the second body part and the first body part is produced.

Or difference of the pattern which it projects the Structured Light projected in one position is input to the dissimilar position of 3D camera of the Structured Light mode and the pattern coming i n into the input are analyzed and 3D information is acquired. In this way, 3D image acquired the first body part, and the second body part is detected at the constant time interval at 1 frame-b y-frame storage, and stored each image frame and 3D coordinate for the second body part and the first body part is produced.

Or it is the means of measuring the electromagnetic wave which is reflected after it emits the microwave having the directivity through the constant time interval in case 3D coordinate presentation means is the radar and comes around and discovering 3D coordinate. In this way, in the information detected at every period, the first body part, and the second body part are detected and 3D coordinate for the second body part and the first body part is produced. Or it is the means of measuring the light which is reflected after it emits the laser beam which has the directivity while the discovering 3D coordinate means rotates at the constant time interval in case 3D coordinate presentation means is the lidar and comes around In this way, in the information detected at each rotation cycle, the first body part, and the second body part are detected and 3D coordinate for the second body part and the first body part is produced.

Or in case the GPS (Global Positioning System) receiver is worn in the first body part and the second body part the arrival time of the electric wave transmitted to every frame in the different position is measured and the distance is calculated and the globe catching each transmission point as the reference point and the arrival range to the radius is produced and the part in which the globe is the same is determined with the position and 3D coordinate for the second body part and the first body part is produced.

Or in case the IPS (Indoor Positioning System) receiver is worn in the first body part and the second body part the arrival time of the ultrasound transmitted to every frame in the different position and electric wave is measured and the distance is calculated or the received signal strength of ultrasound and the electric wave transmitted in the different position is done with the measurement (RSSI, Received Signal Strength Indication) and the distance is calculated and the globe catching each transmission point as the reference point and the arrival range to the radius is produced and the part in which the globe is the same is determined with the position and 3D coordinate for the second body part and the first body part is produced.

Or in case of together wearing 9 axis sensor (the gyro sensor, the acceleration sensor, and the magnetic field sensor) and GPS (Global Positioning System) receiver or the IPS (Indoor Positioning System) receiver in the first body part and the second body part 3D coordinate produced through GPS or IPS is amended through the posture and the exercise information inputted through 9 axis sensor and 3D coordinate for the more correct second body part and the first body part is produced.

In order that the first state (S0) is the need that the second body part of the user certainly completely stops does not have. It looks at that it corresponds to the first state (S0) if only the stopping state sharp-edged tool substantially substantiallies the " 34. In this way, the reason done is to consider the some error existing between the intention and actual motion of the user as if it illustrated.

That is, it has to be satisfied the lower part equation 2 so that the first state (S0) be.

[Equation 2]

$v(t) = r$ 003c# Th_1.

Then, the v (t) is the size of the motion vector at the view t. That is, according to the definition of the motion vector, the v (t) means the size of the speed of the second body part at the view t. If this v (t) is smaller than the first threshold (Th(sub)1(/sub)) , with it is the stopping state the motion vector substantially can define. It need to be the value in which the first threshold (Th(sub)1(/sub)) is enough small. Moreover, it need that the size of the motion vector is very small. There is no condition of the motion vector that φ has to be equipped.

In order that the second state (S1) is it has the speed in which the second body part of the user has the predetermined size, in other words, size more than the second threshold value (Th(sub)2(/sub)) it has to be satisfied the condition of φ. It is for the forward movement to do.

The remarkably the second threshold value (Th(sub)2(/sub)) need to be the big value in comparison with the first threshold (Th(sub)1(/sub)).

For example, the condition in case 6 kinds moving direction is defined for being satisfied the state (S1) of before, as shown in table 1, up and down/left and right forward and backward are same as those of the lower part equation 3.

[Equation 3]

$v(t) = r \geq Th_2$ and $135° \leq \theta \leq 180°$.

In order that the third state (S2) is it has the speed in which the second body part of the user has the predetermined size, in other words, size more than the third threshold (Th(sub)3(/sub)) it has to be satisfied the condition of φ. It is for the back movement to do.

For example, the condition in case 6 kinds moving direction is defined for being satisfied the state (S2) of before, as shown in table 1, up and down/left and right forward and backward are same as those of the lower part Equation 4.

[Equation 4]

$v(t) = r \geq Th_3$ and $0° \leq \theta \leq 45°$.

In order that four the state (S3) is it has the speed in which the second body part of the user has the predetermined size, in other words, size more than the fourth threshold value (Th(sub)4(/sub)) it has to be satisfied the condition of φ. It is for the surface migration to do.

For example, the condition in case 6 kinds moving direction is defined for being satisfied the state (S3) of before, as shown in table 1, up and down/left and right forward and backward are same as those of the lower part equation 5 through the equation 8.

i)It is the upper movement (Upward Motion):

[Equation 5]

$v(t) = r \geq Th_4$ and $45° \leq \theta \leq 135°$ and $45° \leq \varphi \leq 135°$.

ii)It is the down movement (Downward Motion):

[Equation 6]

$v(t) = r \geq Th_4$ and $45° \leq \theta \leq 135°$ and $225° \leq \varphi \leq 315°$.

It is the iii) leftward movement (Leftward Motion) :

[Equation 7]

$v(t) = r \geq Th_4$ and $45° \leq \theta \leq 135°$ and $135° \leq \varphi \leq 225°$.

iv)It is the right shift (Rightward Motion):

[Equation 8]

$v(t) = r \geq Th_4$ and $45° \leq \theta \leq 135°$ and ($315° \leq \varphi$ or $\varphi \leq 45°$).

The gesture is detected based on the combination of the multiple states (S0), state (S1), state (S2), state (S3).

For example, the state (S0) is combined according to the flow over 2 the " hold " gesture in which the hand of user end does not move time can detect.

Or the state (S0) is combined following the state (S1) the gesture in which the hand of user end is engaged in a spot with the " touch (touch) " can detect.

Or the state (S2) is combined following the state (S0) the " release " gesture in which the hand of user end falls down from a spot can detect.

Or (the state (S0) is passed through or it does not pass) state (S2) is combined following the state (S1) the gesture in which the hand of user end is engaged in a spot with the " click (click) " can detect.

Or as to the " drag " gesture which moves to a direction among up and down/left and right with nots becoming intimate that maybe the hand of user end becomes distant from the first body coordinate, the state (S3) is combined over 2 it can detect. In the meantime, in the state (S3), specifically it can know through the range of φ which it is the movement of any kind of direction it before shows in the equation 5 through the equation 8.

Or the state (S0) is combined in the again following the state (S1) the gesture in which the hand of user end is engaged in a spot with the " dip touch (deep touch) " can detect following the state (S1) with the state (S0).

Figure 12 is drawing showing the method detecting the gesture of the user on the virtual spherical surface.

If the motion vector is advance or the lagging behind not issued (it exercises with other words, up and down/left and right) the trajectory of the motion vector forms the virtual spherical surface (1200) done around the first body part (1201).

Fig. 12 exemplified the gesture of the user on such virtual spherical surface (1200) with the several kinds.

The motion vector of the user was the state (S0) and the user was changed from the time (T0) between the time (T1) to the state (S1) and if the user was changed at the time (T1) to the state (S0) , the user can determine that the " touch " gesture was generated in the time (T1).

The state of the motion vector (1220) was changed from the time (T1) between the time (T2) from the state (S1) to (the state (S0) is passed through or it does not pass) state (S3). The virtual spherical surface can be determined in this time interval because the " drag " gesture was generated by up and down/left and right etc. (specifically, it can know through the range of φ which it is the movement of any kind of direction it before shows in the equation 5 through the equation 8)

The state of the motion vector (1230) was changed at the time (T2) from the state (S3) to (the state (S0) is passed through or it does not pass) state (S2). It can determine because the " release " gesture was generated in the time (T2).

Furthermore, if motion vectors (1210,1220,1230) were combined in order from the time (T0) between the time (T3) , through this, for example, any object is chosen (" touch " gesture) and after it pulls to the specific folder and it move (" drag " gesture)s a series of operation of dropping at the folder (" release " gesture) can be implemented.

Figure 13 is drawing showing the method detecting the gesture of the user on the multiple virtual spherical surface.

The virtual spherical surface having the center of common can exist as the some. Moreover, the gesture is assembled and it can come and can go between the virtual spherical surface of the multi-phase.

If such property is utilized , the " dip touch (deep touch) " gesture is implemented and it is possible to detect this.

It is explained using the (n-1) number virtual spherical surface (1300), having the center (1301) the nth virtual spherical surface (1302), and the (n+1) number virtual spherical surface (1303) as an example. (however, the $n \geq 2$, and the n is the integer)

If the touch gesture is detected from the time (T0) between the time (T1) based on the state change of the motion vector (1310) the second body part of the user is positioned on the surface of the (n-1) number virtual spherical surface (1300).

Then, if the hold gesture is detected from the time (T1) between the time (T2) based on the state change of the motion vector (it does not show in drawing) the second body part of the user still stays on the surface of the (n-1) number virtual spherical surface (1300). (the reason which does not show the motion vector in drawing the size of the motion vector is due to be substantially only a little way from the stationary state to 0)

If the touch gesture is again detected from the time (T2) between the time (T3) based on the state change of the motion vector (1320) , the second body part of the user moves to the surface of the nth virtual spherical surface (1302) from the (n-1) number virtual spherical surface (1300).

In this state, if the drag gesture is detected from the time (T3) between the time (T4) based on the state change of the motion vector (1330) , it detects that the second body part of the user exercises on the surface of the nth virtual spherical surface (1302) of up and down/left and right etc. (specifically, it can know through the range of φ which it is the movement of any kind of direction it before shows in the equation 5 through the equation 8)

Then, in the time (T4), if the release gesture is detected based on the state change of the motion vector (1340) the second body part again can move to the surface of the n-1 number virtual spherical surface (1300).

Again, if the touch gesture is detected from the time (T5) between the time (T6) based on the state change of the motion vector (1350) , the second body part can move to the surface of the (n) number virtual spherical surface (1302).

Then, if the hold gesture is detected from the time (T6) between the time (T7) based on the state change of the motion vector (it does not show in drawing) the second body part of the user still stays on the surface of the (n) number virtual spherical surface (1302).

Similarly, if the touch gesture is detected from the time (T7) between the time (T8) based on the state change of the motion vector (1360) , the second body part can move to the surface of the (n+1) number virtual spherical surface (1303).

Then, if the hold gesture is detected from the time (T8) between the time (T9) based on the state change of the motion vector (it does not show in drawing) the second body part of the user still stays on the surface of the (n+1) number virtual spherical surface (1303).

In this way, the gesture implemented in the lower-side, and the virtual spherical surface phase of the multi-phase is possible.

Figure 14 is a block diagram showing an example of the gesture detection apparatus on the user standard spatial coordinate system.

The gesture detection apparatus (1400) includes 3D body coordinate receiving unit (1410), the user standard spatial coordinate system setting unit (1420), and the motion vector analysis section (1430) and gesture detection part (1440). The gesture detection apparatus (1400) can be implemented in the form of the kind of the set top box or the control box. But it is not restricted to such form and such form can be implemented in the form of the server operating on the network. In order to become in the various home device with the embed (embed) or it can be implemented.

3D body coordinate receiving unit (1410) receives multiple body coordinates corresponding to multiple body parts including the first body part (for example, one side eye) and the second body part (the fingertips doing for example, the motion) of the user from the external 3D body coordinate detecting measure.

The apparatus which as described above, is various with 3D camera or radar, lidar etc. can become 3D body coordinate detecting measure.

3D body coordinate receiving unit (1410) is the body coordinate of the user implemented from 3D body coordinate detecting measure as the wireless data communication or the cable data communication mode in the form of the I/O unit (I/O) which the user can receive. Moreover, although not illustrated in the figure, according to the flow of time, the storage (the memory device etc) for temporarily storing multiple body coordinates received at every frame further can be included.

The user standard spatial coordinate system setting unit (1420) produces the user standard spatial coordinate system having the first body coordinate corresponding to the first body part of the user as the origin based on multiple body coordinates received in 3D body coordinate receiving unit (1410).

The motion vector analysis section (1430) produces the subjected motion vector according to the time of the second body coordinate of the gesture detection and the state of the motion vector is judged.

The gesture detection part (1440) detects the gesture of the user based on the change of the state of the motion vector.

Figure 15 is a block diagram which more particularly shows the user standard spatial coordinate system setting unit of the gesture detection apparatus of fig. 14.

The user standard spatial coordinate system setting unit (1420), is the antero-posterior axis setting unit (1422), and the left-right axis setting unit (1424) and top-and-bottom axis setting unit (1426) further are included.

As described above, the antero-posterior axis setting unit (1422) is for the establishment of the antero-posterior axis indicating front and rearward of the user in the user standard spatial coordinate system.

Specifically, the antero-posterior axis setting unit sets up the straight line which altogether passes by the first body coordinate and the second body coordinate as the antero-posterior axis of the user standard spatial coordinate system.

In the antero-posterior axis is the user standard spatial coordinate system, it can be corresponded to the z shaft and it can become the direction of the amount (+) of the z shaft the rearward of the user is similar like. It moreover before illustrates.

It is the block diagram in which fig. 16 more particularly shows the motion vector analysis section of the gesture detection apparatus of 14.

The motion vector analysis section (1430) further includes the motion vector generating unit (1432) and motion vector state judgment part (1434).

The motion vector generating unit (1432) produces the motion vector (**V**) about the second body coordinate (x(sub)1(/sub),y(sub)1(/sub),z(sub)1(/sub)) of the first perspective (t=t(sub)1(/sub)) and the second body coordinate (x(sub)2(/sub),y(sub)2(/sub),z(sub)2(/sub)) of the deuteroscopy (t=t(sub)2(/sub)) in order to have the equation 1 and spherical coordinate illustrated in figure 8.

As described above, the state of the motion vector is determined based on the value of φ component with the r of the motion vector the motion vector state judgment part (1434) is expressed as the Spherical coordinate. It is specified in any one of state of the motion vector as the result, is the stationary state (S0), the forward condition (S1), and the backward state (S2) and surface migration state (S3).

It is the block diagram in which fig. 17 more particularly shows the gesture detection part of the gesture detection apparatus of 14.

The gesture detection part (1440), is the motion vector monitoring unit (1442), and the gesture storage (1444) and gesture determining unit (1446)) further are included.

The motion vector monitoring unit (1442) monitors in the corresponding time whether the change is in the state of the motion vector or not.

For example, the state of the motion vector was the state (S0) in the time (t=t(sub)1(/sub)). However it was the state (S1) in the point of time when going upstream the predetermined time interval. The motion vector monitoring unit (1442) grasps that the state of the motion vector changed into the state (S0) from the state (S1).

The gesture storage (1444) stores the type of the gesture corresponded to each change type at the change type of the state of the motion vector.

For example, in the example of the just before, the type (pattern) changing into the state (S0) from the state (S1) is corresponded to the " touch " gesture. Physically, the state that the hand of user end (the second body part) goes ahead for the preset time and stopping is meant. That is, corresponded to the action in which the user touches one spot of the virtual spherical surface to the fingertips.

Like this, it is corresponded to the gesture in which the combination of the various motion vectors of states is various and the information about the relation of the combination of the state of the motion vector and the gesture corresponding to are stored in the gesture storage (1444). The gesture storage (1444) can be implemented as all kinds of the memory devices.

The type of the gesture corresponding to the change type (pattern) of the state of the motion vector which the gesture determining unit (1446) obtains from the motion vector monitoring unit (1442) is determined with reference to the gesture storage (1444). Finally, it determines that it is the gesture which the gesture of the user the gesture determining unit (1446) performs in the corresponding time and the process of the gesture detection is finished.

Figure 18 is a flowchart showing an example of the gesture detection method on the user standard spatial coordinate system.

In the step (S100), the body coordinate corresponding to each time is received. If the external 3D body coordinate detecting measure is the same like 3D camera , the body coordinate of the user is received at the image frame corresponding to each time.

In the step (S110), since the antero-posterior axis, and the top-and-bottom axis and left-right axis are set up the user standard spatial coordinate system is set up based on the received body coordinate.

In the step (S120), the motion vector about the subjected second body coordinate of the motion and gesture detection are generated in the user standard spatial coordinate system.

In the step (S130), it judges the state of each time of the motion vector.

In the step (S140), the gesture is detected based on the change of the state of the motion vector.

While the flow of this kind of the step (S100) to the step (S140) the gesture detection apparatus continuously operates it is performed.

Therefore, the user determine (S150)s whether the gesture detection apparatus continuously will perform the gesture detection about the user and the user returns to the step (S100) in case of continuously perform (S152)ing. The body coordinate is not any more received in the case (S154) to finish the gesture detection and the operation is terminated.

As described above, the detail content of the invention was looked into through drawing and the various embodiment.

But it is nothing but the example in which this kind of content illustrates the invention. That is, the invention is not restricted to drawing and embodiments but it is obvious that the embodiment and the other any example of change execution belonging to the patent claim belong to the extent of right of the invention.

Brief explanation of the drawing

Drawing in which fig. 1 exemplifies the problem of the conventional gesture recognition technology, and

. Figure 2 is a drawing showing an example of the user standard spatial coordinate system.

Fig. 3 is the force shaft of the user standard spatial coordinate system of 2 the x-axis, and the y-axis and drawing corresponded in the z shaft.

Figure 4 is a drawing showing an example of the method for setting up the top-and-bottom axis and left-right axis of the user standard spatial coordinate system.

Figure 5 is a drawing showing the dissimilar example of the method for setting up the top-and-bottom axis and left-right axis of the user standard spatial coordinate system.

Figure 6 is a drawing showing another example of the method for setting up the top-and-bottom axis and left-right axis of the user standard spatial coordinate system.

It is drawing in which fig. 7 exemplifies the motion vector at the user standard spatial coordinate system.

It is drawing in which fig. 8 expresses the motion vector of 7 in the Spherical coordinate.

Figure 9 is a drawing showing the relation of the direction of the size of θ component of the motion vector comprised of the z shaft and motion vector.

Figure 10 is a drawing showing the relation of the direction of the size of φ component of the motion vector comprised of the x-axis and motion vector.

Figure 11 is a phase diagram (state diagram) showing the transferability status of the motion vector.

Figure 12 is drawing showing the method detecting the gesture of the user on the virtual spherical surface.

Figure 13 is drawing showing the method detecting the gesture of the user on the multiple virtual spherical surface.

Figure 14 is a block diagram showing an example of the gesture detection apparatus on the user standard spatial coordinate system.

Figure 15 is a block diagram which more particularly shows the user standard spatial coordinate system setting unit of the gesture detection apparatus of fig. 14.

It is the block diagram in which fig. 16 more particularly shows the motion vector analysis section of the gesture detection apparatus of 14.

It is the block diagram in which fig. 17 more particularly shows the gesture detection part of the gesture detection apparatus of 14.

Figure 18 is a flowchart showing an example of the gesture detection method on the user standard spatial coordinate system.