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(71) Applicant (for all designated States except US): **ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE** [KR/KR]; 161, Gajeong-dong, Yuseong-gu, Daejeon 305-350 (KR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SIM, Jaecheol** [KR/KR]; #307-608 Songgang Green Apt., Songgang-dong, Yuseong-gu, Daejeon 305-751 (KR). **CHO, Kee-Seong** [KR/KR]; #510-2002 Youlmaemaoul Apt., 877, Jijok-dong, Yuseong-gu, Daejeon 305-769 (KR).

(74) Agent: **SHINSUNG PATENT FIRM**; 2-3F, Line Bldg., 823-30, Yeoksam-dong, Kangnam-ku, Seoul 135-080 (KR).

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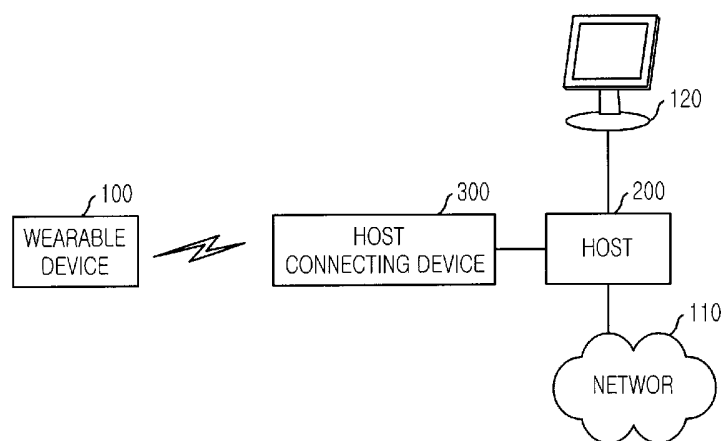
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(54) Title: SYSTEM FOR WEARABLE GENERAL-PURPOSE 3-DIMENSIONAL INPUT



(57) Abstract: Provided are a wearable general-purpose 3-dimensional input system for controlling various devices using single wearable device without using a required controlling device such as a remote controller, a mouse and a pen and a method thereof. The wearable general-purpose three-dimensional wearable system includes: a wearable input unit having a structure wearable on a user for transmitting motion information of the user; and a host unit for analyzing the motion information received from the wearable input unit and feeding back the result to the user.



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SYSTEM FOR WEARABLE GENERAL-PURPOSE 3-DIMENSIONAL INPUT

DescriptionTechnical Field

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The present invention relates to a wearable general-purpose 3-dimensional input system; and more particularly, to a wearable general-purpose 3-dimensional input system for controlling various devices using single wearable
10 device without using a required controlling device such as a remote controller, a mouse and a pen and a method thereof.

Background Art

15 As electronic appliances for home and office have been generalized, various input devices thereof have been introduced to control these electronic appliances.

As an example of the input device, a remote controller is used to control a television set and an audio
20 device, and a keyboard and a mouse are used to control a personal computer (PC). Furthermore, a touch screen or a pen such as stylus may be used for the personal digital assistance (PDA).

Recently, it is common to use two or three of TVs or
25 PCs in single home. Therefore, the number of controlling devices such as the remote controller, the mouse and the pen also increases in proportional to the number of the TVs or PCs used.

Since there are usually many kinds of controlling
30 devices around home, it is annoying to a user to find a proper controlling device such as a remote controller corresponding to a target device to control such as TV whenever the user wants to control the target device.

Meanwhile, the home network and the middleware have
35 been generalized. The concepts of the home network and the

middleware have been applied to control the electronic household or office appliances, conveniently. That is, a user is allowed to control various information electronic appliances connected each others through the home network
5 by transmitting a command to a target device. However, it still requires the input devices such as the remote controller, the mouse and the pen to input the command.

In order to overcome the limitation of the conventional input devices, there were many researches for
10 developing the alternative input devices, for example, a mouse using an acceleration sensor, an input device having an acceleration sensor at a pen tip to sense the motion and having an pressure sensor to sense whether the pen touches the paper or not, and a pen for detecting motions using an
15 acceleration sensor and transmitting the detected information about motion through Bluetooth.

For example, the pen using the acceleration sensor and Bluetooth includes a button and the pen is activated through pushing the button.

20 Furthermore, there was another pen using 3-axes acceleration sensors and an optical sensor disclosed at U.S. Patent Publication No. 2002/0148655A1. This pen enhances the accuracy of the pen movement estimation by compensating the acceleration with an angle formed between the pen and a
25 plane using the optical sensor although the acceleration sensor is used.

The pens may additionally use the pressure sensor to determine whether the pen touches the plane or not to identify a beginning and an ending of stroke.

30 An example of the alternative input device is a universal remote controller, which controls various electronic devices. However, a user should select a target appliance by pushing a corresponding button on the universal remote controller, whenever the user wants to
35 control a TV, a VCR, and an audio system.

For example, if the audio system is connected to a TV, a VCR and a CD player and the user wants to change the channel of the TV and to adjust the volume of the audio system, the user must perform a sequence of operations such as selecting the TV, changing channel, selecting the audio system, and finally adjusting volume. It is very complicated and annoying to the user.

In order to overcome such a drawback, another conventional method of controlling various electronic appliances with the stored controlling information in a supplementary storage was introduced. That is, sequences of operations for the user's specific activity are stored in the additional storage, and once the user selects a target activity by pushing a button, a corresponding sequence is searched and retrieved from the storage. Then, the remote controller executes the sequence of operation.

Further another conventional input device was introduced in Japan Patent Publication No. 2003-143683. The convention input device uses an acceleration sensor to sense the sequence of impacts made when a user taps objects or his body parts. The sensed sequence of impacts is transformed to a predetermined command to control a target device according to pre-defined mapping information that defines impact sequence patterns and related commands.

As described above, these conventional methods and devices must be used to corresponding electronic appliances only although the universal remote controller is used.

In order to control a personal computer that requires complicated control mechanism, a mouse and a digitizing tablet are used. Also, a pen is generally used for portable devices such as a personal digital assistance (PDA).

It is well known that three-dimensional mouse, pen or remote controller may be embodied by monitoring user's motion using an inertial sensor such as an acceleration

sensor and a gyro sensor. However, related conventional technologies are limited to perform functions related to one of the mouse, the pen and the remote controller only. That is, the generality thereof is degraded.

5 As an example of the conventional technology, a mouse using an inertial sensor uses buttons to input data as like as a typical mouse. A pen using an inertial sensor also uses a button or a pressure sensor to identify a beginning and an ending of stroke.

10 Also, the optical sensor or the gyro sensor is additionally used to accurately identify the movement of the pen although the acceleration sensor is used to obtain information related to movement of the pen.

 Such additional buttons and sensors are another
15 limitation to reduce a size of a device or to make a device wearable to a user.

 Also, the conventional technologies are operated as only one of input devices such as a mouse, a pen and a remote controller although the inertial sensor is used.

20

Disclosure

Technical Problem

 It is, therefore, an object of the present invention
25 to provide a wearable general-purpose three-dimensional input system that performs input functions of a remote controller, a mouse and a pen with only one device.

Technical Solution

30

 In accordance with one aspect of the present invention, there is provided a wearable general-purpose three-dimensional wearable system including: a wearable input device having a structure wearable on a user for
35 transmitting motion information of the user; and a host

device for analyzing the motion information received from the wearable input device and feeding back the result to the user.

5 The wearable general-purpose three-dimensional wearable system may further include a host connecting device for connecting the wearable input device to the host device through a wireless link.

Advantageous Effects

10

A wearable general-purpose three-dimensional wearable system according to the present invention can be embodied as an integrated input device that operated as a remote controller, a pen and a mouse according to user's motion and the usage context.

15

A wearable general-purpose three-dimensional wearable system according to the present invention also can control various electronic appliances in a home network or in a ubiquitous environment using a single wearable device.

20

Furthermore, a wearable general-purpose three-dimensional wearable system according to the present invention allows a user to naturally use without using additional buttons. Since it does not require any button, the device can be miniaturized.

25

In a wearable general-purpose three-dimensional wearable system according to the present invention, a wearable device transits between the inactive state and the active state according to the user's motion without using additional switches.

30

Moreover, a wearable general-purpose three-dimensional wearable system according to the present invention senses motions for operating the device using three-axis acceleration sensor without requiring additional sensors.

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A wearable general-purpose three-dimensional wearable

system according to the present invention can be embodied as a ring to be wearable on a user's finger to sense a handwriting motion of a user.

5 Description of Drawings

The above and other objects and features of the present invention will become apparent from the following description of the preferred embodiments given in
10 conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram illustrating a wearable general-purpose three-dimensional wearable system according to a preferred embodiment of the present invention;

Fig. 2 is a block diagram of the host connecting
15 device of the wearable general-purpose three-dimensional wearable system shown in Fig. 1;

Fig. 3 shows an example of using the wearable device
100 shown in Fig. 1;

Fig. 4 is a block diagram illustrating the wearable
20 device 100 shown in Fig. 1;

Fig. 5 shows an example of graphic user interface displayed on a display according to a preferred embodiment of the present invention;

Fig. 6 is a block diagram illustrating the host 200
25 shown in Fig. 1;

Fig. 7 is a block diagram showing a motion analyzing unit of the host 200 according to the present invention;

Figs. 8, 9 and 10 are graphs showing characteristic patterns of acceleration which are compared by the pattern
30 extracting unit 901;

Fig. 11 is a view showing the relation between a user's hand and the wearable device 100 making a motion for handwriting;

Fig. 12 is a graph showing a relation between the
35 wearable device 100 and a plane for handwriting when a user

makes a motion for handwriting using the wearable device 100; and

Fig. 13 is a view showing an example of handwriting made using the wearable device 100.

5

Best Mode for the Invention

Other objects and aspects of the invention will become
10 apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter.

Fig. 1 is a block diagram illustrating a wearable general-purpose three-dimensional wearable system according
15 to a preferred embodiment of the present invention.

As shown in Fig. 1, the wearable general-purpose three-dimensional wearable system according to the present embodiment includes a wearable device 100, a host 200, a host connecting device 300 for connecting the wearable
20 device 100 and the host 200, and a display 120 connected to the host 200. The wearable general-purpose three-dimensional wearable system according to the present embodiment may further include a network 110.

The host 200 may be an information electronic
25 appliance such as a personal computer (PC), a personal digital assistance (PDA) or a set-top box. If the host 200 is capable of wireless communication such as the PC or the PDA, the host 200 may communicate with the wearable device directly without requiring the host connecting device 300.

30 The wearable device 100 periodically senses user's movement and transmits the information related the sensed user's movement to the host 200.

The host 200 receives the transmitted information from the wearable device 100, analyzes the received information
35 and transforms the analyzed information to operations of

mouse, buttons of remote controller and movements of pen.

The host 200 also feeds back an operating mode and movements of the wearable device 100 through the display 120 to a user.

5 The host 200 may control other device connected to the network 10 using the obtained control information through analyzing the movement of the wearable device.

Fig. 2 is a block diagram of the host connecting device of the wearable general-purpose three-dimensional
10 wearable system shown in Fig. 1.

As shown in Fig. 2, the host connecting device 300 includes an antenna 304 and a wireless processing unit 304 for receiving data from the wearable device 100 through a wireless link and processing the received data, a host I/F
15 unit 303 for interfacing with the host 200 and a controlling unit 302 for controlling the wireless processing unit 301 and the host I/F unit 303 and transferring the information.

Fig. 3 shows an example of using the wearable device
20 100 shown in Fig. 1.

As shown in Fig. 3, a user wears a ring type wearable device 100 according to the present invention to control devices 4, which can be controlled by a remote controller 1, a mouse 2 and a pen 3, through a wireless link.

25 Fig. 4 is a block diagram illustrating the wearable device 100 shown in Fig. 1.

As shown in Fig. 4, the wearable device 100 includes an acceleration sensor 101 for sensing a user's motion, a wireless processing unit 103 for transmitting the sensed
30 information to the host device, a controlling unit 102 for receiving the information from the acceleration sensor and transmitting the received information to the wireless processing unit 103, and an antenna 104 for transmitting/receiving signals. The acceleration sensor
35 101, the controlling unit 102 and the wireless processing

unit 103 receives power from a power supply 105.

Fig. 5 shows an example of graphic user interface displayed on a display according to a preferred embodiment of the present invention.

5 As shown in Fig. 5, the host 200 displays controls, i.e., a dial 804, a button 802, a slid bar 803 and a text input window 809, on the display 120.

Fig. 6 is a block diagram illustrating the host 200 shown in Fig. 1, and Fig. 7 is a block diagram showing a motion analyzing unit of the host 200 according to the
10 present invention.

As shown in Fig. 6, the host includes a motion analyzing unit 205, a motion recognizing unit 204, an application/GUI unit 207 and a handwriting recognizing unit
15 208.

As shown in Fig. 7, the motion analyzing unit 205 of the host 200 includes a characteristic pattern extracting unit 901, a tilt estimating unit 902, a tilt compensating unit 903, a state information managing unit 906 and
20 integrating units 904, 905, 907 and 908.

Hereinafter, the wearable general-purpose three-dimensional wearable system according to a preferred embodiment of the present invention will be described in detail with reference to Figs. 4 through 7.

25 The controlling unit 102 of the wearable device 100 constantly monitors motions of user using the acceleration sensor 101 in an inactive state of the wearable device 100. If the motion of user is sensed by the acceleration sensor 101, the wearable device 100 transits from the inactive
30 state to an active state. Then, the wearable device 100 transfers the motion information from the acceleration sensors of each axis 101 to the host 200 through the wireless processing unit 103 and the antenna 104.

The wearable device 100 may transit from the inactive
35 state to the active state by comparing a value denoting a

size of the user's movement outputted from the acceleration sensors 101 to a threshold value that is previously defined. The value denoting the size of the user's movement may be obtained by squaring absolute values of accelerations of each axis, adding the squared results and calculating a square root of the added result.

In the present embodiment, repeated movements over the threshold in a predetermined time interval are defined as a motion to transit from the inactive state to the active state as shown in Table 1.

The wearable device 100 transfers three-dimensional motion information that is information about movements of each axis of the wearable device to the motion analyzing unit 205 and the motion recognizing unit 204.

The motion analyzing unit 205 analyzes the three-dimensional motion information from the wearable device 100 with coordinates of the controls displayed on the display 120 and its operating mode for the wearable device 100.

If the operating mode for the wearable device 100 is a mouse, the motion analyzing unit 205 analyzes the three-dimensional motion information as two-dimensional movement or a mouse button state change. The motion analyzing unit 205 transfers the analyzed information to the application/GUI unit 207 to move a mouse pointer 806 according to the analyzed information.

On the contrary, if the operating mode of the wearable device transits from the mouse to a pen by selecting the text input window 809, the application/GUI unit 207 displays proper pointers 807 and 808 on the screen 801, and the motion analyzing unit 205 transmits the two-dimensional motion information and information about a beginning of a stroke and an ending of stroke to the handwriting recognizing unit 208 to recognize the user's handwriting.

The recognized character at the handwriting recognizing unit 208 is transferred to the application/GUI

unit 207 and displayed on the text input window 809.

The motion recognizing unit 204 compares the motion of the wearable device 100 to pre-defined motions using the operating mode information for the wearable device 100 provided by the motion analyzing unit 205 and pre-defined motion-command relation information.

If the motion information from the wearable device 100 is matched with one of the predefined motions, the command information of the matched predefined motion is transmitted to the application/GUI unit 207.

The handwriting recognition unit 208 and the motion recognizing unit 204 may be implemented based on various handwriting recognition and motion recognition algorithms which are widely known to those skilled in the art. Therefore, the detail thereof is omitted.

Since a preferable sensitivity differs according to a user, the sensitivity information set by the user to transit the operating mode is provided to the motion analyzing unit 205.

The acceleration sensor 101 measures acceleration when the object having the sensor moves and outputs the measured acceleration. The speed of movement can be calculated by integrating the measured acceleration. And the distance of movement can be calculated by integrating the speed.

The acceleration sensor 101 includes an acceleration sensor senses three axes such as X, Y, and Z. Therefore, the speed and the distance made by an object in the three-dimensional space can be obtained.

When the wearable device 100 is used as a mouse, the obtained speed and the obtained travel distance are transmitted to the application /GUI unit 207 with the button state information analyzed at the state information managing unit 906. As a result, the motion of the wearable device 100 is transformed to operations of a mouse on the display such as clicking of a mouse button or moving of a

mouse pointer.

If a user wears the wearable device 100 having the acceleration sensor on a finger and moves the finger with the wearable device 100, different acceleration patterns are obtained according to the movements of the wearable device 100. That is, start and stop in free space, stop by bumping against an object, changing movement direction into the opposite direction show the unique acceleration patterns.

10 In the present invention, the characteristic pattern extracting unit 901 compares the inputted acceleration pattern with the predefined patterns and outputs the matched pattern.

A well known pattern matching algorithm in signal processing may be used for the determination of matching. The matched pattern is used to change the operation mode for the wearable device.

Figs. 8, 9 and 10 are graphs showing characteristic patterns of acceleration, which are compared by the character pattern extracting unit 901.

The wearable device 100 periodically measures acceleration with the acceleration sensor 101 and transmits the measured acceleration information to the host 200.

As shown in Fig. 9, if the acceleration is changed from + to - or from - to + more steeply than a predetermined steepness set by the user, the acceleration information is interpreted as that the wearable device 100 moves into the opposite direction.

As shown in Fig. 8, if the acceleration is attenuated and oscillated after a sharp + or - acceleration, it is interpreted as that the wearable device is stopped by bumping against an object.

As shown in Fig. 10, if + or - acceleration is slowly shown, it is interpreted as that the wearable device 100 begins to move or stops after moving.

Fig. 9 is a view showing the relation between a user's hand and the wearable device 100 making a motion for handwriting, and Fig. 10 is a graph showing a relation between the wearable device 100 and a plane for handwriting when a user makes a motion for handwriting using the wearable device 100.

In the conventional input system, the movement of the input system can be directly observed because the sensor is included in the mouse or the pen. However, the wearable device 100 according to the present invention cannot directly observe the movement of the pen when the user writes with the wearable device.

Fig. 11 is a view showing an example of handwriting made using the wearable device 100.

As shown in Fig. 11, when a user writes using a pen, the wearable device can only sense the smaller movement 504 compared to the movement 505 of a pen tip on the plane.

As shown in Fig. 9, when the wearable device 100 is operated in the pen mode, the individual grip styles for a pen 603 are different from each other and the wearing styles for the wearable device on finger are different too. So, the tilt of the wearable device on the plane 601 is not constant.

That is, X, Y, Z axis 604 and 704 of the planes 605 and 701 are tilted to X, Y, Z axis 703 of the wearable device 100.

In order to accurately estimate a trajectory of the pen movement on the plane 605, an angle 705 between the pen movement plane 605 and the plane 604 of the wearable device 100 must be obtained. The accelerations of each axis are measured and the angle 105 is calculated from the measured acceleration.

At the time when the pen or the finger touches the plane, the acceleration pattern shown in Fig. 8 is observed. Such an acceleration pattern is detected from the

characteristic pattern extracting unit 901 and the input acceleration pattern is transmitted to the tilt estimating unit 902.

If maximum acceleration values of each axis that are observed from the pattern are x, y, and z, a vector $D = (x, y, z)$ becomes vertical to the plane on which the pen moves.

The tilt estimating unit 902 calculates an angle formed by two vectors $D = (x, y, z)$ and $S = (0, 0, z')$ denoting a vector of a plane where the finger touches using a following Eq. 1 when the pattern of Fig. 8 is detected.

$$\cos^{-1} \frac{D \cdot S}{|D||S|} \quad \text{Eq. 1}$$

For example, if the X and the Y axes of the wearable device 100 are parallel to the plane where the pen moves, only movement of the z axis is detected when the pen touches the plane.

In this case, the movement of the pen on the plane can be observed by detecting movements on the X and the Y axes using the sensor of the wearable device 100 on the finger.

On the contrary, if the movement of the X axis is sensed only, the movements of the Y and the Z axes are detected to observe the movement of the pen to write a stroke.

As described above, if the movement of only one axis is sensed, the movement information of other two axes is fully reflected by the accuracy of the sensor because the movement of the pen is parallel to the plane.

However, if movements of more than two axes are sensed, the acceleration of device detected by the sensor will be the exaggerated acceleration afterwards.

For example, if the X axis and the plane form the angle θ , the real acceleration of the X axis x is equal to $x' \cos\theta$ where x' is a measured acceleration of the X axis.

The tilt compensating unit 903 compensates the acceleration by performing the shown equation for the acceleration measured by the sensor using the tilt calculated at the tilt estimating unit 902.

5 The integrating unit 904 converts the compensated acceleration to a speed through integrating the compensated acceleration and the integrating unit 905 converts the speed to a distance through integrating the speed again.

10 The compensated speed for each axis and the distance are transmitted to the handwriting recognizing unit 208 with the stroke begin and end information obtained at the state information managing unit 906.

15 As described above, following input methods can be provided using the wearable general-purpose three-dimensional wearable system according to the present invention as follows. Since the following input methods are one of embodiments of the present invention, it may be modified according to a user.

20 <Start using device>

A user begins an interaction to the host 200 with a predefined motion such as shaking the wearable device 100 to the right and the left several times.

25 If the controlling unit 102 of the wearable device 100 senses movement identical to the predefined motion under a predetermined condition, the controlling 102 realizes the detected movement as activation of the device. Therefore, the controlling 102 communicates to the host 200 and transmits the three-dimensional motion information
30 outputted from the sensor.

The host 200 analyzes the three-dimensional motion information transmitted from the wearable device 100 as shown in Fig. 6.

35 In this case, the host 200 regards the wearable device 100 to perform functions of mouse. Therefore, the host 200

displays a mouse pointer on a display to notice that the user begins operations.

<Operate as mouse>

5 When the user moves the wearable device 100, the acceleration sensor detects the three-dimensional motion information thereof, and the wearable device 100 transmits the three-dimensional motion information to the host 200.

10 The host 200 analyzes the three-dimensional motion information of the wearable device 100 to find corresponding movement of the mouse. For example, the host 200 may analyze a motion of quickly moving the finger in the upward and the downward directions as a clicking operation of the mouse.

15 If the user makes such a motion twice, the host regards that as the double clicking operation of the mouse.

 If the user stops to move the finger after moving the finger up and down, the host regards that as activation of right button of the mouse.

20

<Select control>

 When a mouse pointer is located on a predetermined control, the host 200 regards a motion of moving the finger up and down as the selection of the control.

25 Then, if the user moves the finger to right and left, the host 200 regards that as controlling a dial or a sliding bar. If the user moves the finger in the upward direction, the host 200 regards that as release of selection.

30 Meanwhile, if the user moves the finger up and down when the mouse point is on a text input window, the host 200 regards this motion to transit the operating state of the wearable device to a pen from the mouse.

35 <Operate as pen>

When the wearable device 100 is operated as the pen, the user is allowed to write texts by holding a pen or using the finger wearing the wearable device as the pen.

Herein, the acceleration sensor senses the motion of the wearable device 100 as a beginning of valid stroke 501 by detecting a sudden stop motion generated from the wearable device 100 when the pen or the finger touches the plane.

Also, the acceleration sensor sets a reference plane 704 of the plane where the pen moves by calculating the three-dimensional accelerations when the acceleration sensor detects the sudden stop motion.

Then, detected movements of the wearable device 100 are analyzed as two-dimensional movements 505 on the reference plane and the movement information of stroke is indirectly calculated when the user makes a handwriting motion.

If the user moves the pen vertically or about vertically upwards from the reference plane, the host 200 regards this motion as ending of stroke 502.

The movements 504 from the beginning of stroke and the ending of stroke are transmitted to the handwriting recognizing unit and they are recognized as control operations such as texts, space or backspace.

While the wearable device 100 is operated as the pen, movements 503 of the wearable device 100 before the beginning 501 of valid stroke and the ending 502 of the valid stroke are regarded as movements of mouse. Therefore, these movements are displayed as the movement of the mouse pointer on the display instead of the stroke 505.

<Return to mouse from pen>

If the user shakes the finger after the user moves the pen in up direction from the plane because of finishing inputting of text, the motions of the user is regarded as

returning to the mouse operating state.

<Remote controller mode>

When the wearable device 100 is operated as the mouse,
 5 the host 200 also determines whether the movements of the
 wearable device 100 are matched to the predefined motions
 for the remote controller.

When the user selects one of devices such as an audio
 system and a video player having functions previously
 10 defined according to the present invention, or when the
 user activates one of applications predefined according to
 the present invention, the host 200 determines whether the
 movement of the user is matched to operations defined
 according to the device or the application at first.

15 If the user's movement is matched, this motion is
 regarded as the control command for the selected device and
 the control command is transferred to the device and the
 application.

If the user's movement is not matched, this motion is
 20 regarded as moving the mouse pointer.

For example, if a TV is selected, a motion of stopping
 the finger after quickly moving the finger to right (left)
 is analyzed as reducing the volume, or a motion of stopping
 the finger after quickly moving the finger to upward
 25 (downward) may be analyzed as changing the channel.

The following Table 1 shows transition between the
 operation modes of a wearable device, conditions, a motion
 of finger for entering corresponding operation mode and
 meaning thereof according to a preferred embodiment of the
 30 present invention.

Table 1

Operation mode of wearable	Condition	Motion of finger	Meaning
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device			
Inactive	Sudden repetition	⇔⇔⇔	Transit to active state (mouse mode)
Mouse		↔	Move mouse to left and to right
Mouse		↖ ↘	Move mouse to up and down
Mouse		⇧	Click of mouse
Mouse	Pointer must be located on control	⇧	Select control
Mouse	Select control	↖ ↘ ↔	Movement of mouse to right, left, up and down according to characteristics of control
Mouse	Select control	↑	Release of selected control
Mouse	Select device usable by remote controller	Operation defined previously	Unique function of device allocated to operation defined previously
Mouse	Activated application usable by remote controller	Operation defined previously	Unique function of device allocated to operation defined previously
Mouse	Sudden repetition	⇔⇔⇔	Transit to inactive mode
Mouse	Text input window	⇧	Transit to pen mode

Pen			Beginning of stroke
Pen	After beginning of stroke	Any movement	Movement of pen writing stroke
Pen	After beginning of stroke	↑	Ending of stroke
Pen	Before beginning of stroke and after ending of stroke	Any movement	Movement between strokes
Pen	After ending of stroke	↑	Move cursor to where point is
Pen	After ending of stroke	⇔⇔⇔	End pen mode, Transit to mouse mode
Mouse	Sudden repetition	⇔⇔⇔	Transit to inactive mode

⇔: move to left and right quickly

↔: move to left and right slowly or normally

↖ ↘: move upward and downward slowly or normally

||: move downward and stop by dump object

5 ↑: move upward

||↑: sequence of movement that move downward, stop by dump object and move upward.

10 A user may be allowed to select and define convenient motions as operations of wearable device under each operation mode and conditions. Therefore, the embodiment shown in table 1 may vary according to the user's preference.

15 The above described method according to the present invention can be embodied as a program and stored on a computer readable recording medium. The computer readable recording medium is any data storage device that can store data which can be thereafter read by the computer system.

The computer readable recording medium includes a read-only memory (ROM), a random-access memory (RAM), a CD-ROM, a floppy disk, a hard disk and an optical magnetic disk.

5 While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. A wearable general-purpose three-dimensional input system comprising:

5 wearable input means having a structure wearable on a user for transmitting motion information of the user; and

 host means for analyzing the motion information received from the wearable input means and feeding back the result to the user.

10

2. The wearable general-purpose three-dimensional wearable system as recited in claim 1, further comprising host connecting means for connecting the wearable input means to the host means through a wireless link,

15 wherein the host connecting means includes;

 wireless communicating means for receiving the motion information from the wearable input means through an antenna; and

 host interfacing means for transmitting the
20 receive motion information to a host.

3. The wearable general-purpose three-dimensional wearable system as recited in claim 1, wherein the wearable input means includes:

25 acceleration sensing means for generating motion information by sensing motion of user;

 wireless communicating means for transmitting the motion information to the host means through a wireless link; and

30 controlling means for controlling the acceleration sensing means, the wireless communicating means, monitoring the motion information and transmitting the motion information.

35 4. The wearable general-purpose three-dimensional

wearable system as recited in claim 3, wherein the acceleration sensing means includes a x-axis sensor, a y-axis sensor and a z-axis sensor for sensing the motion of the user in three-dimensional space.

5

5. The wearable general-purpose three-dimensional wearable system as recited in claim 1, wherein the host means is operated as one of a mouse mode, a pen mode and a remote controller mode and transits it's mode to another according to the motion information.

10

6. The wearable general-purpose three-dimensional wearable system as recited in claim 1, wherein the host means includes:

15

motion analyzing means for receiving and analyzing the motion information and feeding back the result thereof to a user using visual information according to the corresponding mode;

20

motion recognizing means for outputting command information corresponding to the motion information; and

user interfacing means for transmitting a control signal and an input signal to an external user device according to the command information.

25

7. The wearable general-purpose three-dimensional wearable system as recited in claim 6, wherein the host means further includes a handwriting recognizing unit for recognizing the motion information as character.

30

8. The wearable general-purpose three-dimensional wearable system as recited in claim 6, wherein the motion analyzing means uses an acceleration pattern to analyze the motion.

35

9. The wearable general-purpose three-dimensional

wearable system as recited in claim 8, wherein the acceleration pattern is one of:

5 a first acceleration pattern where the acceleration is changed from + to - or from - to + more steeply than a predetermined steepness;

a second acceleration pattern where the acceleration is attenuated and oscillated without showing the sharp acceleration of opposite direction after + or - acceleration is suddenly shown; and

10 a third acceleration pattern where + or - acceleration is shown slowly.

10. The wearable general-purpose three-dimensional wearable system as recited in claim 9, wherein the motion
15 analyzing means interprets the first acceleration pattern as that the wearable input means starts to move in the opposite direction of the previous movement direction.

11. The wearable general-purpose three-dimensional
20 wearable system as recited in claim 9, wherein the motion analyzing means analyzes the second acceleration pattern as that the wearable input means stops by bumping to an object.

12. The wearable general-purpose three-dimensional
25 wearable system as recited in claim 9, wherein the motion analyzing means analyzes the third acceleration pattern as that the wearable input means begins to move or stops while moving.

30 13. The wearable general-purpose three-dimensional wearable system as recited in claim 12, wherein the motion analyzing means does not use input by a button or a switch.

14. The wearable general-purpose three-dimensional
35 wearable system as recited in claim 6, wherein in the pen

mode, tilt information between the wearable input means and a plane is calculated based on acceleration of the moment the wearable input means touches the plane, and the subsequent accelerations are compensated according to the
5 calculated tilt information.

15. The wearable general-purpose three-dimensional wearable system as recited in claim 6, wherein in the pen mode, a beginning and an ending of stroke are identified
10 according to an acceleration pattern of the moment that a body part wearing the wearable input means or a pen taken by the body part touches the plane or moves apart from the plane.

15 16. The wearable general-purpose three-dimensional wearable system as recited in claim 6, wherein in the pen mode, the movement of the wearable input means is used as a substitute for a movement of user's hand or pen tip when a user wears the wearable input means on user's finger as
20 like as a ring.

17. The wearable general-purpose three-dimensional wearable system as recited in claim 3, wherein the controlling means change the running mode of the wearable
25 input means by the monitored motion information from the acceleration sensing means.

18. The wearable general-purpose three-dimensional wearable system as recited in claim 3, wherein the host
30 means generates signals corresponding to an operation of a button or a switch by interpreting the motion information generated from the acceleration sensing mean although the wearable input means does not include buttons and switches.

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FIG. 1

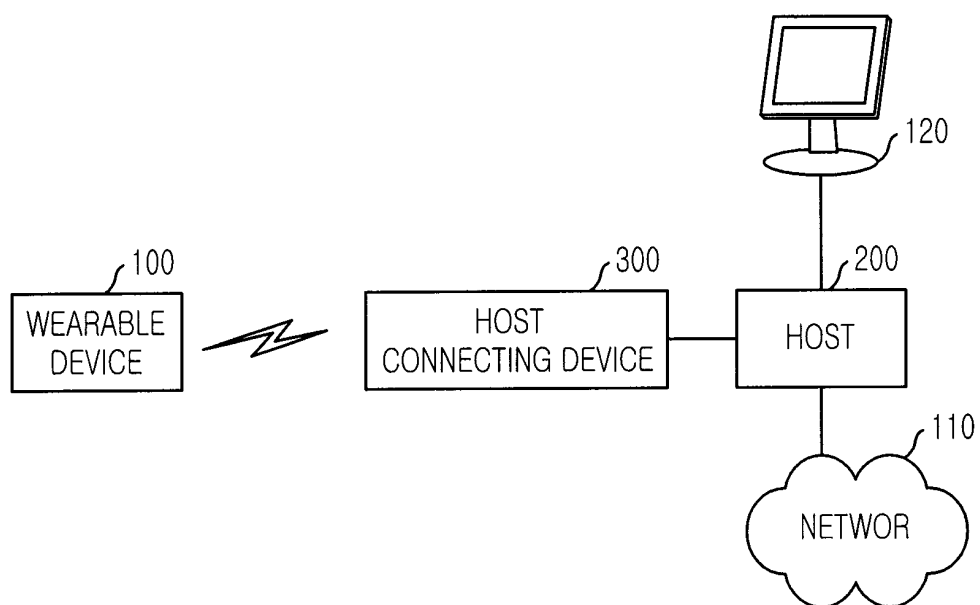
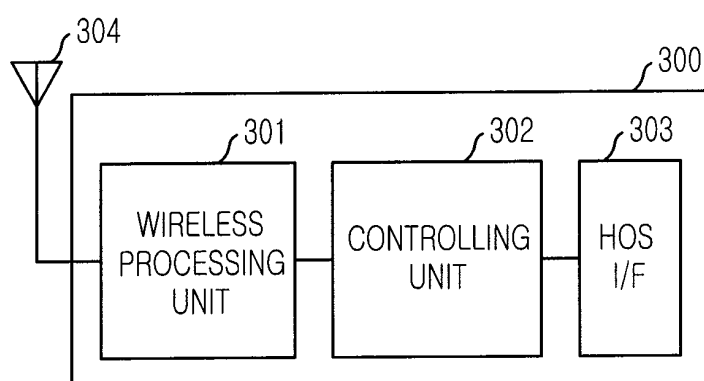


FIG. 2



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FIG. 3

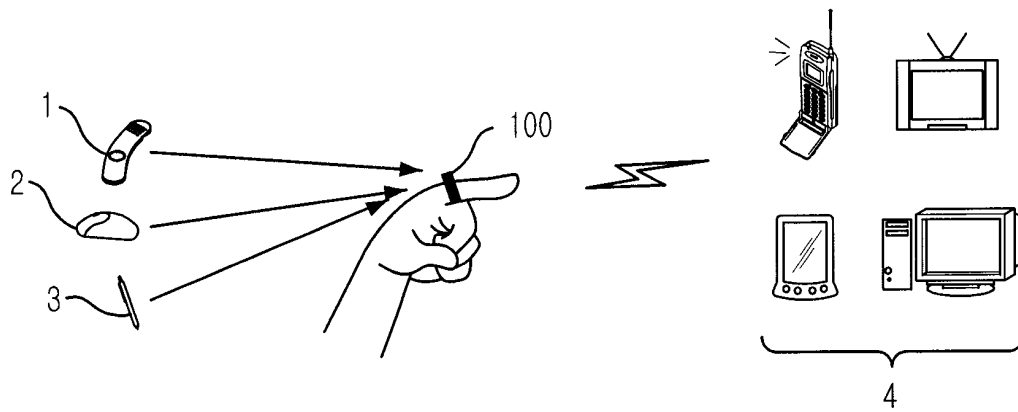
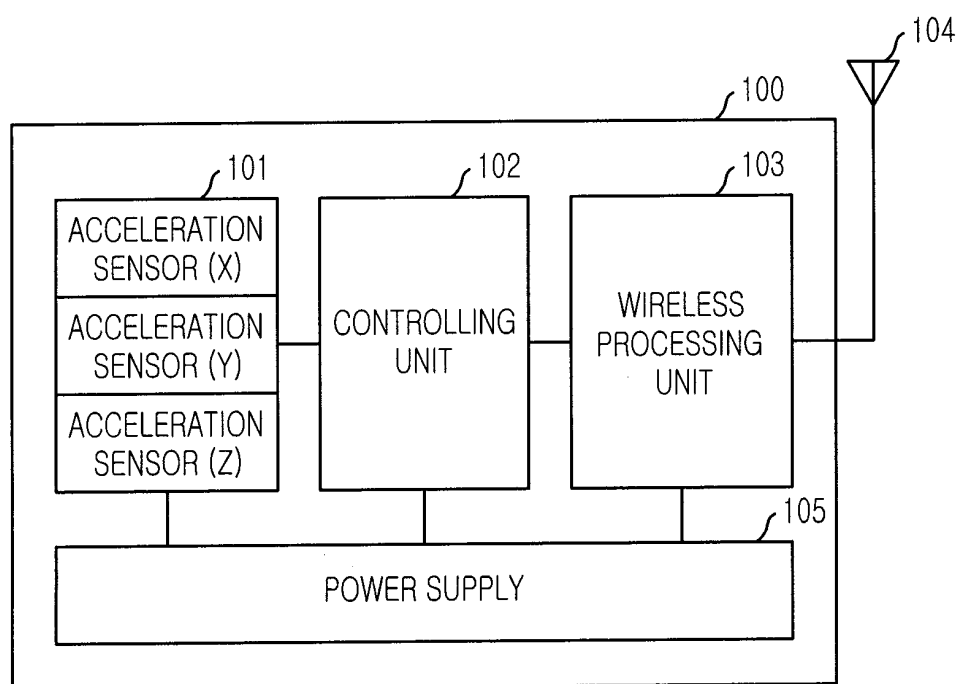


FIG. 4



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FIG. 5

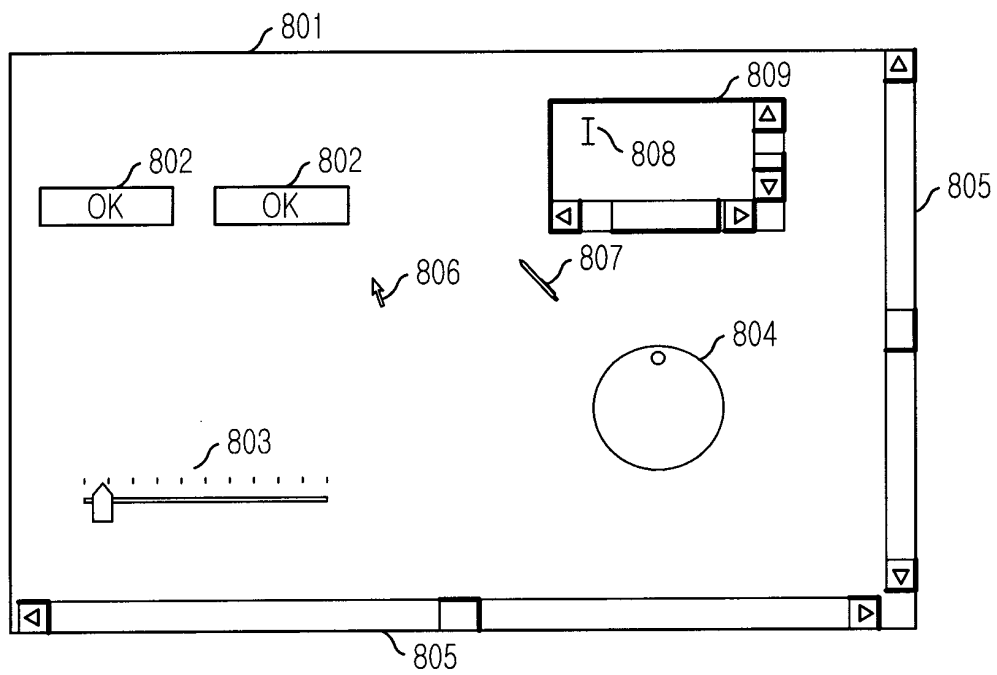


FIG. 6

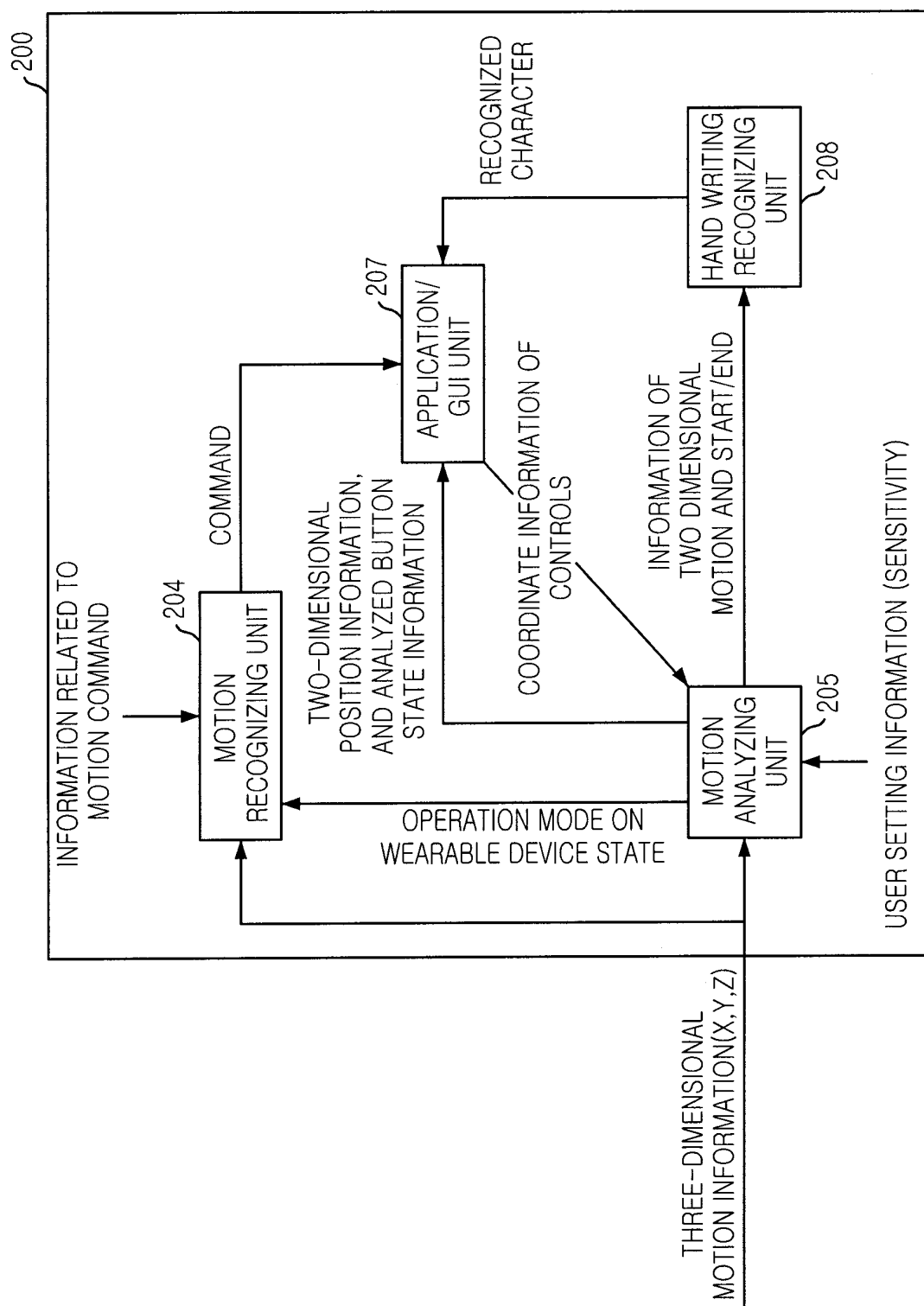
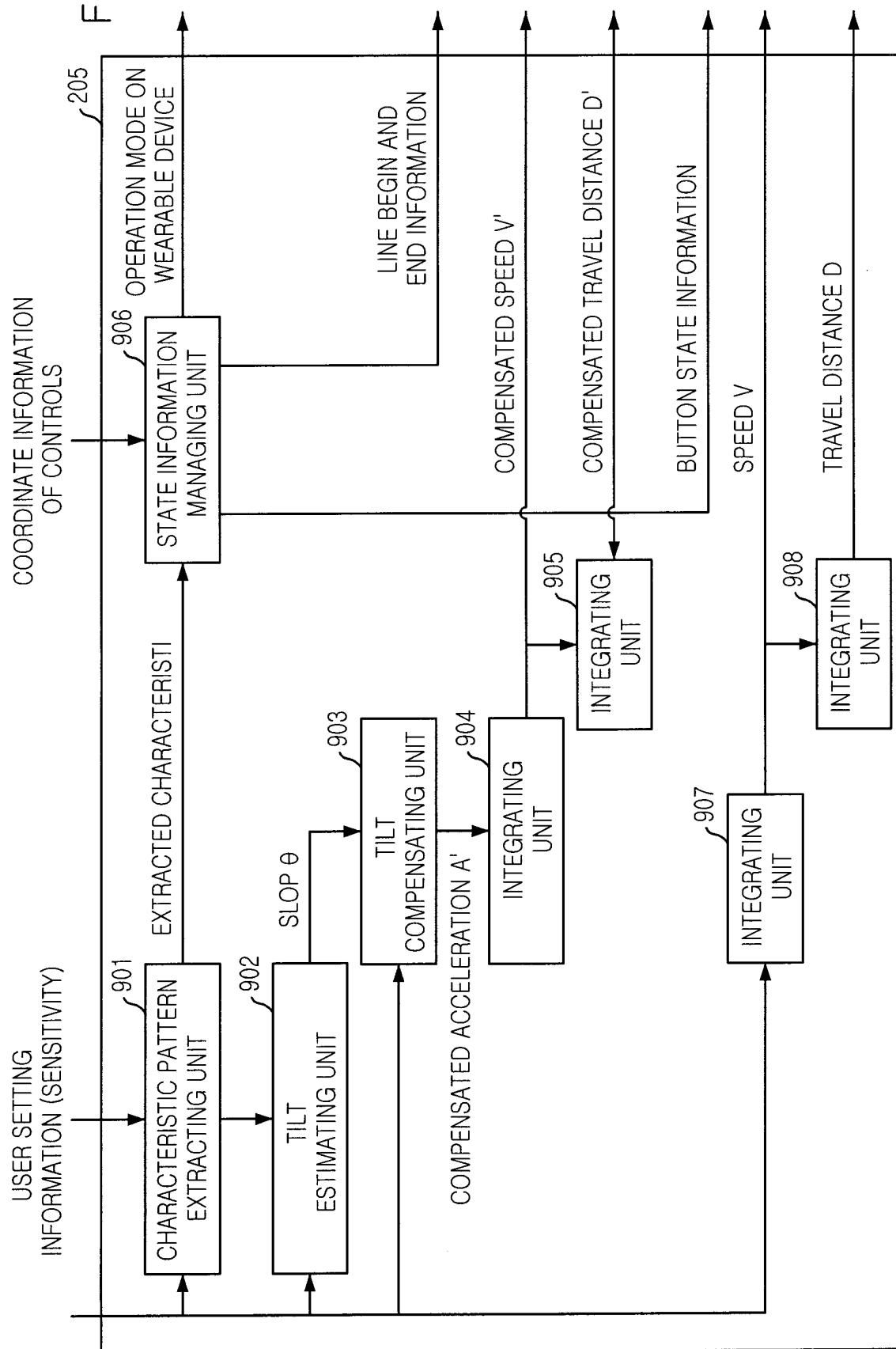


FIG. 7



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FIG. 8

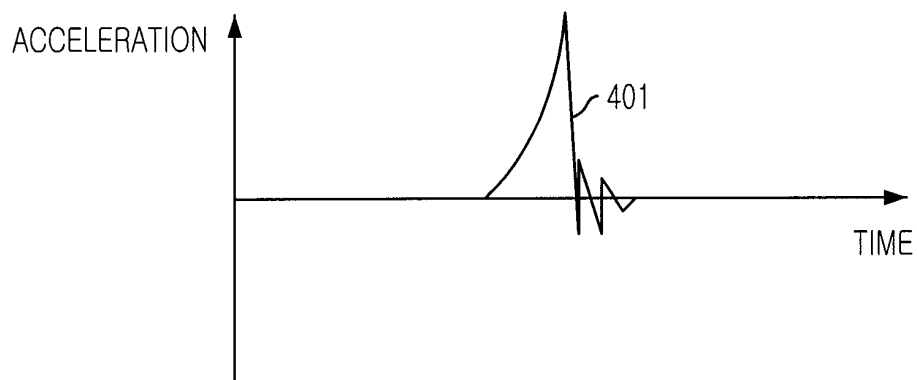


FIG. 9

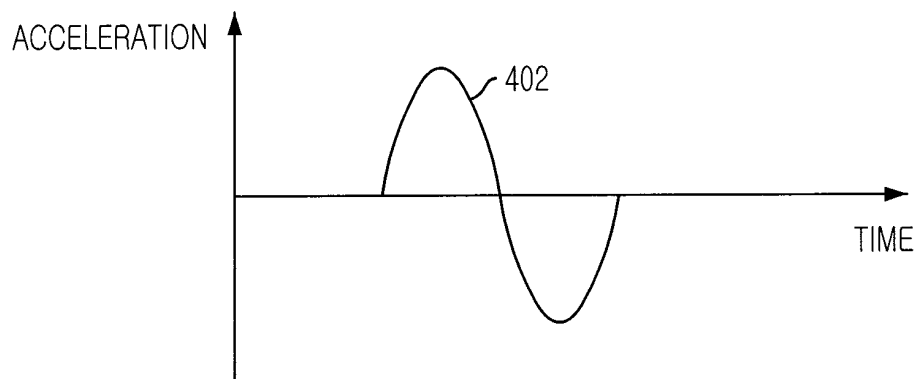
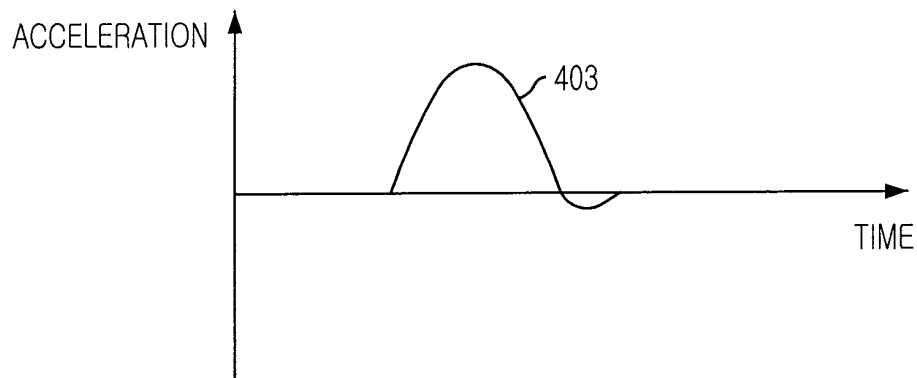
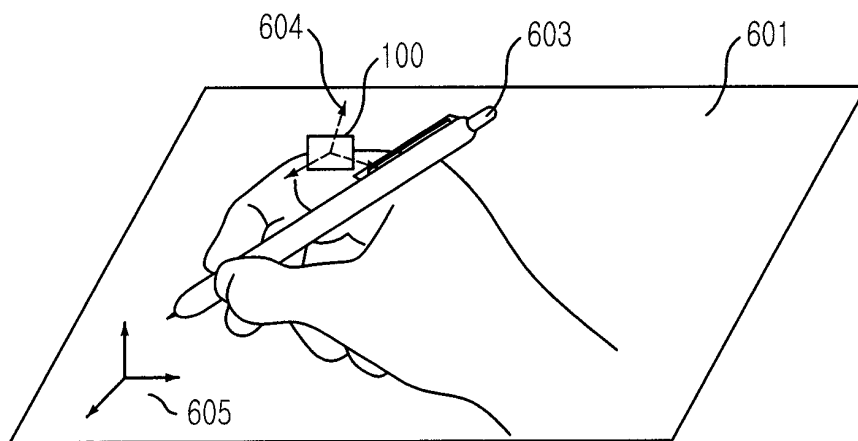


FIG. 10



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FIG. 11



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FIG. 12

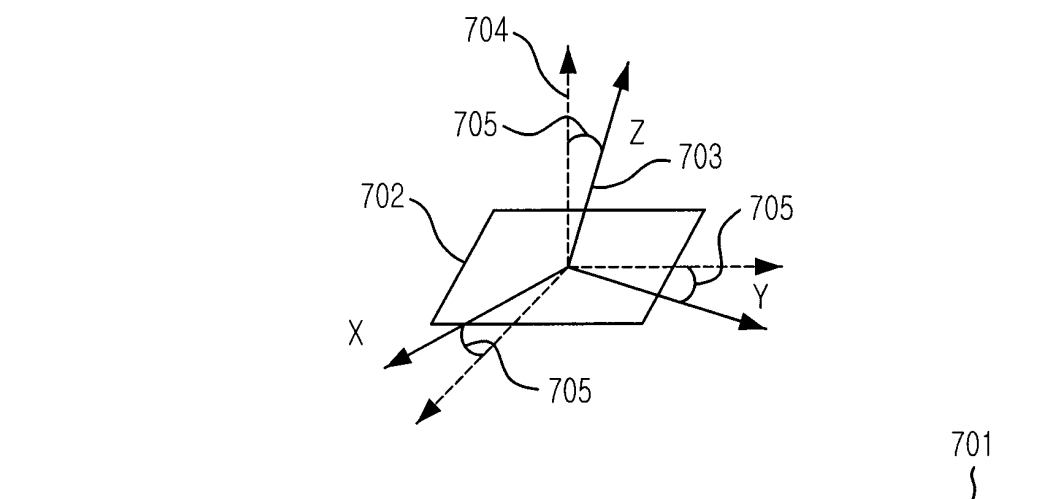
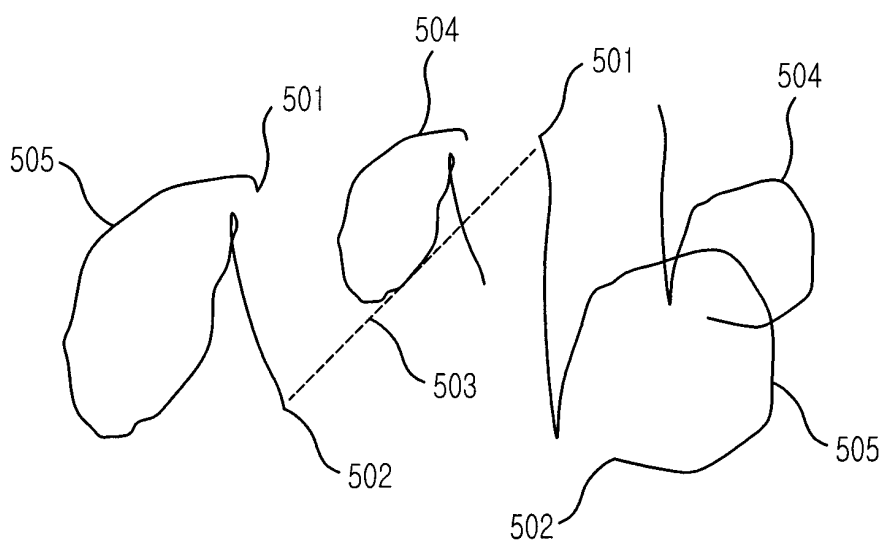


FIG. 13



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2005/002264

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 G06F 3/02**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 G06F 3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patents and applications for inventions since 1975

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS "WEARABLE, INPUT"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2002-358149 A (SONY CORP) 13 DECEMBER 2002 the whole document	1-18
A	US 2003/0011573 A1 (SAMSUNG ELECTRONICS CO., LTD.) 16 JANUARY 2003 see the abstract	1
A	KR 2004-81223 A (CHOI, HOO KON etc.) 21 SEPTEMBER 2004 see the claims and drawings	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search

21 OCTOBER 2005 (21.10.2005)

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Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea

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Authorized officer

KANG, Gab Youn

Telephone No. 82-42-481-5914



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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