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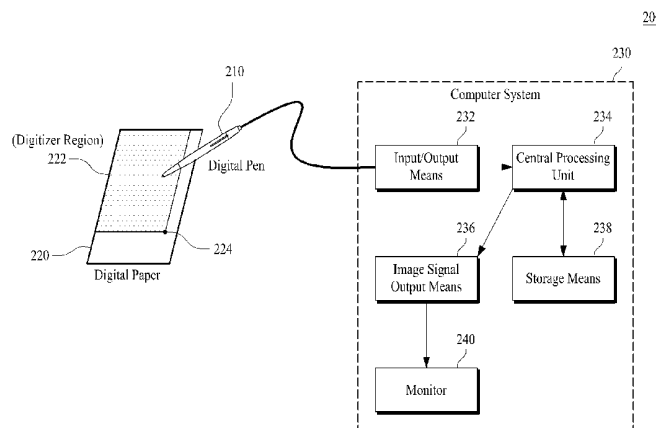
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[Fig. 2]



(57) Abstract: Disclosed is a digitizer device using digital paper and a digital pen, as well as a method for providing a digitizer function by using the same. The digitizer device includes digital paper having an absolute position display pattern printed thereon; a recognition means for recognizing the absolute position display pattern on the digital paper; a conversion means for calculating a coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern of the absolute position display pattern and converting the coordinate value according to a standard digitizer data format to create a digitizer coordinate value; and an application means for converting the digitizer coordinate value according to a screen ratio value, creating a resultant by a digitizer application, and outputting the resultant. Advantageously, a digitizer function is provided by using a digitizer device using digital paper and a digital pen so that more users are provided with universal digitizer input devices that are easily carried and inexpensive.

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Description

METHOD AND APPARATUS FOR PROVIDING DIGITIZER FUNCTIONS BY USING DIGITAL PAPER AND PEN

Technical Field

- [1] The present invention relates to a digitizer device using digital paper and a digital pen, as well as a method for providing a digitizer function by using the same. More particularly, the present invention relates to a digitizer device using digital paper having an absolute position display pattern and a digital pen for recognizing a unit cell pattern on the digital paper so that, after the coordinate value of a corresponding position in the absolute position display pattern is recognized, processed into data suitable for a standard digitizer format, and transmitted to a computer system, the data is converted based on consideration of the resolution ratio of the entire monitor or a portion of the monitor to output the created resultant, as well as a method for providing a digitizer function using the same.

Background Art

- [2] As generally known in the art, digital image input devices (e.g. digital cameras, camcorders) are widely used as a result of the development of information and communication technology, the trend toward an information-oriented society, and the widespread use of personal computers (e.g. laptops, desktops).
- [3] In addition, various image editing programs (e.g. Photoshop available from Adobe Systems Incorporated, DaVinci Photo, Photoshoot) enable users to edit various images, including photographs, images downloaded via the Internet, etc. For example, users can correct indistinct images, conduct special filtering, compose a number of images, etc.
- [4] Particularly, rapidly developing Internet technology has allowed more people to share virtual space via the Internet and enjoy communication. In this case, many interesting and valuable image materials are made public to draw other's attention.
- [5] Furthermore, individuals more frequently make digital albums and exchange personal images as gifts. This increasingly necessitates image editing, and some people can handle image editing programs on an expert level.
- [6] Such an image editing process requires sophisticated manipulation, but the use of basic input devices of computers (i.e. keyboard and mouse) limits the degree of sophistication during image editing.
- [7] Therefore, some users employ digitizers to edit images. As used herein, a digitizer refers to a device for detecting coordinates within a predetermined range of the screen to input pictures, characters, figure information, etc. as digital data.

- [8] More particularly, digitizers, which are adapted to convert analog data into digital-format data, read the coordinate of the original input so that design drawings, figures, etc. are inputted to computers. Referring to FIG. 1, a conventional digitizer, which is used to input the position of X, Y coordinates, includes an electronic device 100 having a flat, large square shape so that the position coordinate value can be extracted with regard to the contact surface, and a cursor device 110 having a pen or a button so that the user can use it on the electronic device 100. When the user moves the pen or cursor, the lower plate reads the coordinate information and automatically transfers it to the screen storage place of the computer system. If the pen or button is pressed in a specific position, the corresponding command is executed.
- [9] As such, the digitizer decomposes photographic images, lines of printed characters, etc. into electronic bits and memorizes/stores them in the computer so that they can be retrieved to reproduce original images when necessary. The digitizer is also used to input figure data to the computer or to modify figures on the graphic display screen.
- [10] However, conventional digitizers based on electronic devices have a problem in that they are too large to be carried conveniently and, as digitizers become larger, the manufacturing cost and product price rise immeasurably. This means that, although they are very convenient to input figures or pictures to computers, conventional digitizers are not easily available to general consumers.
- [11] In other words, digitizers require additional costs that are too high for general customers to use them for practical purposes. As a result, the majority of people still use conventional keyboards and mice to edit images in spite of some inconveniences.

Disclosure of Invention

Technical Problem

- [12] Therefore, the present invention has been made in view of the above-mentioned problems, and the present invention provides a digitizer device using digital paper having an absolute position display pattern and a digital pen for recognizing a unit cell pattern on the digital paper so that, after the coordinate value of a corresponding position in the absolute position display pattern is recognized, processed into data suitable for a standard digitizer format, and transmitted to a computer system, the data is converted based on consideration of the resolution ratio of the entire monitor or a portion of the monitor to output the created resultant, as well as a method for providing a digitizer function using the same.

Technical Solution

- [13] In accordance with an aspect of the present invention, there is provided a digitizer device for providing a digitizer function, including digital paper having an absolute position display pattern printed thereon; a recognition means for recognizing the

absolute position display pattern on the digital paper; a conversion means for calculating a coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern of the absolute position display pattern and converting the coordinate value according to a standard digitizer data format to create a digitizer coordinate value; and an application means for converting the digitizer coordinate value according to a screen ratio value, creating a resultant by a digitizer application, and outputting the resultant.

- [14] In accordance with another aspect of the present invention, there is provided a method for providing a digitizer function by a digitizer device including digital paper having an absolute position display pattern printed thereon, a recognition means for recognizing the absolute position display pattern, a conversion means for calculating a coordinate value and converting the coordinate value to create a digitizer coordinate value, and an application means for outputting a resultant by using the digitizer coordinate value, the method including the steps of (a) recognizing the absolute position display pattern by the recognition means; (b) calculating the coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern of the absolute position display pattern and converting the coordinate value according to a standard digitizer format to create the digitizer coordinate value by the conversion means; and (c) receiving the digitizer coordinate value, converting the digitizer coordinate value according to a screen ratio value, creating the resultant through a provided digitizer application, and outputting the resultant by the application means.
- [15] In accordance with another aspect of the present invention, there is provided an input device for providing a digitizer function, including an optical system/lens for optically inputting at least one unit cell pattern; an absolute coordinate calculation sensor for recognizing an image of the unit cell pattern and calculating a coordinate value of an absolute coordinate; a microcontroller for processing information inputted from the absolute coordinate calculation sensor, calculating a relative coordinate by using the amount of variation of the absolute coordinate, and converting the coordinate value of the absolute coordinate and the relative coordinate according to a standard digitizer data format to create a digitizer coordinate value; an internal memory for storing predetermined information under the control of the microcontroller and storing information regarding the standard digitizer data format; and a USB interface for communicating with the application means under the control of the microcontroller.
- [16] In accordance with another aspect of the present invention, there is provided an application device connected to digital paper having an absolute position display pattern printed thereon and to an input device for recognizing the absolute position display pattern on the digital paper so that a digitizer function is provided, the application

device including a USB input/output means for receiving information regarding the absolute position display pattern from the input means; a central processing unit for driving a recognition device driver and management software to calculate a coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern by using the information regarding the absolute position display pattern, converting the coordinate value into a digitizer coordinate value conforming to a standard digitizer data format, and controlling reception, management, conversion, and output of the coordinate value and the digitizer coordinate value; a storage means for storing at least one of the recognition device driver and the management software for calculating the coordinate value and converting the coordinate value into the digitizer coordinate value; and a monitor for outputting the resultant created from the digitizer coordinate value.

Advantageous Effects

- [17] The present invention is advantageous in that a digitizer function is provided by using a digitizer device using digital paper and a digital pen so that more users are provided with universal digitizer input devices that are easily carried and inexpensive.
- [18] In addition, the inventive device can easily implement functions that are difficult to conduct by conventional mice, e.g. drawing pictures or writing small letters on the computer. This guarantees real-time implementation of various functions on line, including chatting, handwriting mail, tutorial correction, etc.

Brief Description of the Drawings

- [19] The foregoing and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:
- [20] FIG. 1 briefly shows a conventional digitizer device;
- [21] FIG. 2 briefly shows a digitizer device using digital paper and a digital pen according to an exemplary embodiment of the present invention;
- [22] FIG. 3 briefly shows the detailed construction of a digital pen according to an exemplary embodiment of the present invention;
- [23] FIG. 4 briefly shows digital paper having an absolute position display pattern on its surface according to an exemplary embodiment of the present invention;
- [24] FIGs. 5-8 illustrate a method for assigning the X coordinate of an absolute position display pattern according to an exemplary embodiment of the present invention;
- [25] FIGs. 9-12 illustrate a method for assigning the Y coordinate of an absolute position display pattern according to an exemplary embodiment of the present invention;
- [26] FIG. 13 shows another example of digital paper having an absolute position display pattern on the surface created by combining the patterns shown in FIGs. 7 and 11

according to the present invention;

- [27] FIG. 14 shows exemplary construction of directional flags having no directive feature;
- [28] FIG. 15 shows the number of cases of direction flag cell distribution that can appear on a coordinator window;
- [29] FIG. 16 shows exemplary codes of binary data displayed at first cells according to an exemplary embodiment of the present invention;
- [30] FIG. 17 shows X and Y coordinate values corresponding to meaning values of respective line segments shown in FIG. 16;
- [31] FIG. 18 shows exemplary codes of binary data displayed at second cells according to an exemplary embodiment of the present invention;
- [32] FIG. 19 shows other exemplary codes of binary data displayed at second cells according to an exemplary embodiment of the present invention;
- [33] FIG. 20 shows still other exemplary codes of binary data displayed at second cells according to an exemplary embodiment of the present invention;
- [34] FIG. 21 illustrates a method for extracting relative coordinates according to an exemplary embodiment of the present invention;
- [35] FIG. 22 illustrates another method for extracting relative coordinates according to an exemplary embodiment of the present invention;
- [36] FIG. 23 shows exemplary sensors of a digital pen according to an exemplary embodiment of the present invention;
- [37] FIG. 24 illustrates a method for providing a digitizer function by using digital paper and a digital pen according to an exemplary embodiment of the present invention;
- [38] FIG. 25 illustrates how to set a digitizer region by a digitizer device according to the present invention;
- [39] FIG. 26 illustrates how a user uses a digitizer function provided by a digitizer device according to an exemplary embodiment of the present invention;
- [40] FIG. 27 shows exemplary digital paper according to an exemplary embodiment of the present invention; and
- [41] FIGs. 23-31 show exemplary setup screens for providing a digitizer function by a digitizer device according to an exemplary embodiment of the present invention.

Best Mode for Carrying Out the Invention

- [42] Hereinafter, exemplary embodiments of the present invention will be described with reference to the accompanying drawings. In the following description and drawings, the same reference numerals are used to designate the same or similar components, and so repetition of the description on the same or similar components will be omitted. Furthermore, a detailed description of known functions and configurations in-

corporated herein is omitted to avoid making the subject matter of the present invention unclear.

Mode for the Invention

- [43] FIG. 2 briefly shows a digitizer device using digital paper and a digital pen according to an exemplary embodiment of the present invention.
- [44] A digitizer device 200 according to an exemplary embodiment of the present invention includes a digital pen 210, digital paper 220, and a computer system 230.
- [45] Particularly, the present invention provides digital paper 220 having a specific pattern (a set of points arranged according to predetermined rules so that coordinate values can be extracted) printed thereon, a recognition means/device for recognizing an absolute position display pattern on the digital paper 220, a conversion means for calculating the coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern of the absolute position display pattern and converting the calculated coordinate value according to a standard digitizer data format so that a digitizer coordinate value is created, and an application means/device for converting the digitizer coordinate value according to a screen ratio value, creating a resultant by a digitizer application, and outputting the resultant. As such, the present invention is characterized in that, without separate complicated electronic devices, the conventional digitizer function is provided simply by the digital paper 220 and the digital pen 210. Therefore, the digital pen 210 of the digitizer device 200 according to the present invention may either include all of the above-mentioned input means and conversion means or solely include the input means. Alternatively, the application means, i.e. computer system 230, may include the conversion means.
- [46] To this end, the digitizer device 200 according to the present invention is based on digital paper fabrication technology for creating and printing a specific pattern indicating coordinates and digital pen technology for recognizing the specific pattern and extracting coordinates, so that the recognized coordinate values are converted into standard digitizer data and transmitted to the computer system 230.
- [47] Referring to FIG. 3, the digital pen 210 includes an optical system/lens 310 for optically inputting at least one unit cell pattern; a variation amount calculation sensor 320 for measuring the amount of variation of the coordinate value of an absolute coordinate; an absolute coordinate calculation sensor 330 for recognizing the image of the inputted unit cell pattern and calculating the absolute coordinate; a microcontroller 340 for processing information inputted by the variation amount calculation sensor 320 and the absolute coordinate calculation sensor 330; an internal memory 350 for storing predetermined information under the control of the microprocessor 350; and a USB interface 360 for communicating with the computer system 230 under the control of

the microcontroller 350.

- [48] The digital pen 210 according to an exemplary embodiment of the present invention is adapted to recognize an absolute position display pattern in a digitizer region 222, which is designated on the digital paper 220 having an absolute position display pattern according to the present invention, and extract the absolute coordinate of the unit cell pattern 410.
- [49] More particularly, the digital pen 210 recognizes an image of binary data codes included in respective cells constituting a unit cell pattern 410, and calculates binary data of the corresponding unit cell pattern 410 by using the binary data codes of respective cells. The digital pen 210 calculates the absolute coordinate (including X and Y coordinates) of the corresponding unit cell pattern 410 based on the calculated binary data. When the user moves the digital pen 210, the digital pen 210 calculates the relative coordinate based on the amount of variation of the absolute coordinate. Then, the digital pen 210 converts the coordinate value of the absolute and relative coordinates according to the standard digitizer data format, and transmits the converted coordinate value (i.e. digitizer coordinate value) to the computer system 230.
- [50] Although it has been assumed in the above description that the digital pen 210 according to the present invention includes both the variation amount calculation sensor 320 and the absolute coordinate calculation sensor 330, the construction is not limited to that assumption. For example, the digital pen 210 may solely have the absolute coordinate calculation sensor 330. Alternatively, the digital pen 210 may have both the variation amount calculation sensor 320 and the absolute coordinate calculation sensor 330.
- [51] Assuming that the digital pen 210 incorporates only the absolute coordinate calculation sensor 330, which functions at least 60 times per second (first case), the trajectory of the digital pen 210 can be perfectly expressed by the value of an absolute coordinate that is obtained at least 60 times per second. If the amount of movement (variation) to the current position relative to a specific point on the trajectory is to be obtained, the amount of variation is easily determined from the difference in coordinate value between the absolute coordinates of the reference point and the current position. The amount of instantaneous variation of the digital pen 210 can be obtained from the difference in coordinate value between the absolute coordinates of two adjacent points on the trajectory.
- [52] Assuming that the digital pen 210 incorporates both the absolute coordinate calculation sensor 330 and the variation amount calculation sensor 320 and that the absolute coordinate calculation sensor 330 functions at least 60 times per second (second case), the trajectory of the digital pen 210 can be perfectly expressed by only the value of an absolute coordinate that is obtained at least 60 times per second. In

other words, this case is the same as the first case, in which the digital pen 210 incorporates only the absolute coordinate calculation sensor 330 that functions at least 60 times per second.

- [53] Assuming that the digital pen 210 incorporates both the absolute coordinate calculation sensor 330 and the variation amount calculation sensor 320 and that the absolute coordinate calculation sensor 330 functions less than 60 times per second, the amount of relative movement (variation) is recognized by using the variation amount calculation sensor 320 while the coordinate value of an absolute coordinate is sensed/calculated to express the trajectory of the digital pen 210. The amount of relative movement is used to create a detailed trajectory between two points, the position of which is given as an absolute coordinate value. In other words, information obtained by the variation amount calculation sensor 320 can be used to secure the coordinate value of absolute coordinates in more positions. After the coordinate value of the absolute coordinate of every point is obtained in this manner, the coordinate value of the relative coordinate or the amount of variation is calculated in the same manner as in the first case.
- [54] In addition, although it has been assumed in the above description of the digitizer device 200 according to an exemplary embodiment of the present invention that the digital pen 210 is adapted to recognize an absolute position display pattern and obtain the coordinate value of the absolute coordinate and/or relative coordinate of the unit cell pattern 410, the construction of the digitizer device 200 is not limited to that assumption. For example, the recognition device driver or management software of the computer system 230 may receive an absolute position display pattern recognized by the digital pen 210 and calculate the coordinate value of the corresponding unit cell pattern 410. The recognition device driver and the management software will be described later in more detail.
- [55] The digital pen 210 according to the present invention stores data related to the standard digitizer data format in the internal memory 350, and the microcontroller 350 uses the standard digitizer data format-related data stored in the internal memory 350 to convert the coordinate value of absolute and relative coordinates according to the standard digitizer data format, which is a generally used digitizer data format.
- [56] The digital pen 210 according to an exemplary embodiment of the present invention refers to a product having an absolute position display pattern, which is a set of points arranged according to predetermined rules so that coordinate values can be extracted, as will be described later in more detail.
- [57] The computer system 230 is provided with a recognition device driver and management software. The computer system 230 converts a coordinate value (value of an absolute or relative coordinate) recognized by the digital pen 210 and the digital

paper 220 according to the format of the digitizer by using standard digitizer formats and transmission standards, and outputs the value. Alternatively, the computer system 230 receives an absolute position display pattern recognized by the digital pen 210, calculates the coordinate value of the corresponding unit cell pattern 410, converts the calculated value according to the digitizer format, and outputs the converted value.

- [58] The computer system 230 according to an exemplary embodiment of the present invention includes a USB input/output means 232 connected with the digital pen 210 to receive information regarding an absolute position display pattern or a coordinate value; a central processing unit 234 for controlling the overall operation of the computer system 230, driving a recognition device driver and management software to provide the digitizer function according to the present invention, calculating the coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern 410 by using the information regarding an absolute position display pattern, converting the coordinate value into a digitizer coordinate value, and controlling the processes of receiving, managing, converting, and outputting the coordinate value; an image signal output means 236 for receiving image signals from the central processing unit 234 and transferring them to the monitor 240; and a storage means 238 for storing a recognition device driver, management software, etc. for providing the digitizer function according to the present invention.
- [59] As used herein, the recognition device driver refers to a program for providing hardware information, etc. so that, when the digital pen 210 according to the present invention is connected to the computer system 230, it can function as a digitizer, i.e. so that the computer system 230 recognizes the digital pen 210 as a standard digitizer. Particularly, the recognition device driver refers to a program for managing coordinate values transmitted from the digital pen 210 and digitizer coordinate values, converting the digitizer coordinate values by applying a screen ratio value set by the management software, and transferring the converted digitizer coordinate values to various applications.
- [60] The management software compares the resolution of the digitizer region 222, which refers to a region to be used for digitizer application tasks on the digital paper 220, with that of the entire monitor 240 of the computer system 230 or a portion of the monitor 240 to be used so that the ratio value to be applied for coordinate value conversion is calculated. More particularly, the user executes a ratio value setup screen by using the management software, and clicks the rightmost bottom 224 of a portion of the digital paper 220, which is to be used as the digitizer region 222, with the digital pen 210. The digitizer region 222 is designated in this manner. Then, the resolution of the digitizer region 222 is compared with that of the entire monitor 240 or a portion of it to be used so that the X and Y ratio values are automatically calculated and and

stored.

- [61] The recognition device driver and the management software also receive an absolute position display pattern of a unit cell pattern 410, which has been recognized by the digital pen 210 from the digital paper 220, calculate the coordinate value (value of absolute coordinate and/or relative coordinate) of the corresponding unit cell pattern 410, and convert the calculated coordinate value into a digitizer coordinate value conforming to the standard digitizer data format.
- [62] FIG. 4 briefly shows digital paper having an absolute position display pattern on its surface according to an exemplary embodiment of the present invention, particularly an absolute position display pattern of digital paper.
- [63] Referring to FIG. 4, an absolute position display pattern formed on the surface of digital paper 220 according to the present invention includes first cells 401 displaying binary data codes, second cells 402 displaying binary data codes of a type distinguished from the first cells 401 or having no data, and unit cell patterns 410 consisting of at least a predetermined number of first and second cells 401 and 402.
- [64] As shown in FIG. 4, each cell 401 of the digital paper 220 according to the present invention displays a binary data code (detailed later in detail with reference to FIGs. 16 and 18), which indicates the X and Y coordinates of each cell 401. From the binary data code, the X and Y coordinates of each cell, i.e. binary data such as (0,0), (0,1), (1,0), or (1,1), can be extracted.
- [65] In other words, respective cells 401 and 402 of the digital paper 220 display binary data codes (each binary data code indicates proper X and Y coordinates depending on the type), as shown in FIGs. 16-20. The digital pen 210 can create binary data, i.e. each cell's own (X,Y) coordinate, from the type of the binary data codes, and FIG. 4 shows binary data of respective cells created in this manner.
- [66] Although it has been assumed in the description of an exemplary embodiment of the present invention that binary data is encoded and displayed at respective cells 401 and 402, the data is not limited to binary data. For example, the data may be based on a numeral system having a radix larger than 2 (e.g. 3 or 4) depending on the number of code types.
- [67] According to an embodiment of the present invention, a unit cell pattern 410 refers to a set of cells 401 and 402 of NxM (4x4) size, which can be read as a whole by the sensing means (i.e. pointer of the digital pen 210) and recognized separately. The unit cell pattern 410 is also called a window. Such a 4x4 unit cell pattern 410 consists of thirteen first cells 401 and three second cells 402. Although it has been assumed in the description of an exemplary embodiment of the present invention that N and M, which specify the size of the unit cell pattern 410, are identical, they may differ from each other.

- [68] According to an embodiment of the present invention, the combination of binary data corresponding to thirteen first cells 401 indicates the value of an absolute coordinate (including X and Y coordinates) of the corresponding unit cell pattern 410 (also referred to as a window value). In addition, three second cells 402 are placed in a predetermined position (i.e. right lower corner) within the unit cell pattern 410 so that the second cells 402 are joined by line segments in a predetermined shape (i.e. '┘'). Such a set of three second cells 402 placed in predetermined position and shape within the unit cell pattern 410 is referred to as a direction flag 403. The position of the direction flag 403 is determined so that the unit cell pattern 410 is distinguished from other adjacent unit cell patterns, and the shape is determined to identify the direction of the digital paper 220, i.e. the degree of rotation of the digital paper 220, as will be described later in more detail.
- [69] Although it has been assumed in the description of an embodiment of the present invention that the direction flag 403 has the shape of '┘', the shape is not limited to that, and the direction flag 430 may have various shapes (e.g. '┐', '└') as long as it indicates the condition of rotation of the digital paper 220.
- [70] An exemplary method for assigning X and Y coordinates of the absolute position display pattern according to the present invention will now be described in more detail with reference to FIGs. 5-12.
- [71] Method for assigning X coordinate in absolute position display pattern
- [72] FIG. 5 shows exemplary unit cell patterns 410 in a row of an absolute position display pattern according to the present invention. Although respective cells contain data regarding both X and Y coordinates, as shown in FIG. 4, FIG. 5 separately shows data regarding the X coordinate for convenience of illustration.
- [73] Referring to FIG. 5, the binary window value of the unit cell patterns 410 gradually increases by 1 in the X direction (rightward direction):
0000000000000→0000000000001→0000000000010→0000000000011. The binary window value corresponds to a combination of binary data, which corresponds to thirteen first cells 401 within each unit cell pattern 410, in the order from 1 to 13 shown in FIG. 6. Such a gradual increase of the binary window value of the unit cell patterns 410 by one in the X direction (rightward direction) guarantees that, even if the coordinate window does not accurately coincide with the actual window, the actual window value can be restored based on the regularity. As used herein, the coordinate window refers to a set of cells actually read by the coordinate sensing means (i.e. pointer of the digital pen 210), and is larger than the size of the unit cell patterns (i.e. window size). However, it is to be noted that, during actual application, images observed by the coordinate sensing means (pointer of the digital pen 210) may be larger than the coordinate window.

- [74] The unit cell patterns 410 in a row shown in FIG. 5 are repeatedly arranged in the Y direction (vertical direction) so that they span over a plurality of rows, as shown in FIG. 7.
- [75] FIG. 8 shows an embodiment alternative to that shown in FIG. 5. Referring to FIG. 8, the window value does not necessarily begin from 0, but an arbitrary value can be the starting value. The pen for reading the window value is informed of this fact. When the window value relative to the starting point is to be obtained, the arbitrary value is subtracted from the currently read window value. If the maximum value that can be displayed by all window values is reached, the next window value can be set to be 0.
- [76] Method for assigning Y coordinate in absolute position display pattern
- [77] FIG. 9 shows exemplary unit cell patterns 410 in a column of an absolute position display pattern according to the present invention. Although respective cells contain data regarding both X and Y coordinates, as shown in FIG. 4, FIG. 9 separately shows data regarding the Y coordinate for convenience of illustration.
- [78] Referring to FIG. 9, the binary window value of the unit cell patterns 410 gradually increases by 1 in the Y direction (downward direction):
0000000000000→0000000000001→0000000000010→0000000000011. The binary window value corresponds to a combination of binary data, which corresponds to thirteen first cells 401 within each unit cell pattern 410, in the order from 1 to 13 shown in FIG. 10. Such a gradual increase of the binary window value of the unit cell patterns 410 by one in the Y direction (downward direction) guarantees that, even if the coordinate window does not accurately coincide with the actual window, the actual window value can be restored based on the regularity.
- [79] Although respective cells are assigned X coordinates in the order shown in FIG. 6 and Y coordinates in the order shown in FIG. 10, it is also possible to commonly apply the order shown in FIG. 6 or 10 to assign both X and Y coordinates. Alternatively, the order shown in FIG. 6 is applied with regard to Y coordinates, and the order shown in FIG. 10 is applied with regard to X coordinates. Although not shown in the drawings, the positional number of binary data of each cell may increase along a spiral curve starting from the center of the same window (unit cell pattern).
- [80] The unit cell patterns in a column shown in FIG. 9 are repeatedly arranged in the X direction (horizontal direction) so that they span over a plurality of columns, as shown in FIG. 11.
- [81] FIG. 12 shows an embodiment alternative to that shown in FIG. 9. Referring to FIG. 8, the window value does not necessarily begin from 0, but an arbitrary value can be the starting value. The digital pen 210 for reading the window value is informed of this fact. When the window value relative to the starting point is to be obtained, the arbitrary value is subtracted from the currently read window value. If the maximum

value that can be displayed by all window values is reached, the next window value can be set to be 0.

- [82] Respective cells constituting an absolute position display pattern on the digital paper 220 according to the present invention are assigned X coordinate values in the manner shown in FIG. 7, as well as Y coordinate values in the manner shown in FIG. 11. Then, the X and Y coordinate values (shown in FIGs. 7 and 11, respectively) in the same cell position are combined to obtain an absolute position display pattern according to the present invention, as shown in FIG. 13.
- [83] A comparison between the absolute position display patterns shown in FIGs. 4 and 13 reveals that the binary data values assigned to corresponding cells slightly differ. Such a difference results from the varying methods for assigning/combining binary data corresponding to first cells 401 within the unit cell pattern 410, as has been described with reference to FIGs. 6 and 10. Particularly, the absolute position display pattern shown in FIG. 4 corresponds to an example of applying the order of assigning/combining binary data shown in FIG. 10 to both X and Y coordinates. The absolute position display pattern shown in FIG. 13 corresponds to an example of applying the order of assigning/combining binary data shown in FIG. 6 to X coordinates and applying the order of assigning/combining binary data shown in FIG. 10 to Y coordinates. However, in either case of the absolute position display patterns shown in FIG. 4 and 13, the coordinate value of the absolute coordinates of corresponding unit cell patterns is the same.
- [84] The direction flag 403 will be described in more detail with reference to FIG. 4.
- [85] Second cells 402 constituting a direction flag 403 must be arranged so that the direction flag itself has a directive feature. This requires at least three second cells 402. If a smaller number of second cells constitute a direction flag, it has at least two directive features no matter how the second cells are arranged. However, if the direction flag 403 is not to be used for rotation sensing, but just for error correction, two or more cells may constitute the direction flag 403. Furthermore, if the direction flag 403 is simply used to distinguish between adjacent unit cell patterns 410, the direction flag 403 may consist of only one second cell 402.
- [86] When the direction flag 403 is not used for error correction, but solely for rotation sensing, the second cells 402 contain no information. Alternatively, the second cells 402 contain information encoded and displayed in a manner distinguished from the first cells 401 to make it known that they constitute a direction flag 403.
- [87] When the direction flag 403 is solely used for rotation sensing, it is enough to use three second cells 402 containing no information, and the three cells are preferably joined by line segments in the shape of '┐'.
- [88] Some arrays of three cells have no directive feature because the three cells are

arranged along a straight line, as shown in FIG. 14, or because they have no center point, and are preferably excluded.

- [89] Assuming that '┐' -shaped direction flags are used, there are three possible types of distribution of second cells 402, as shown in FIG. 15a, FIG. 15b, and FIG. 15c, which can be considered on a coordinate window to find the angle or rotation (90° , 90° , 270°) of digital paper 220 having an absolute position display pattern printed thereon. Particularly, all cells are positioned next to one another on a coordinate window in the case of FIG. 15a, cells are divided into two groups in the case of FIG. 15b, and cells are divided into three groups in the case of FIG. 15c.
- [90] In any case of FIG. 15a, FIG. 15b, and FIG. 15c, a cell C acting as the center point is located first, and it is recognized that other cells spaced relative to the cell C are positioned on the opposite side of the center point. The rotated direction flag 403 is restored in this manner.
- [91] If the restored direction flag has the shape of '┐', it indicates clockwise 90° rotation. Similarly, '┐' indicates 180° rotation, and '┐' indicates counterclockwise 90° rotation. For example, the direction flag shown in FIG. 15a has not rotated; restoration of the direction flag shown in FIG. 15b gives the shape of '┐' and indicates clockwise 90° rotation; and restoration of the direction flag shown in FIG. 15c gives the shape of '┐' and indicates 180° rotation. Such characteristics are used to obtain the angle of rotation of the digital paper 220, and make it possible to rotate a matrix of cells on the coordinate window accordingly.
- [92] The correction of errors of an absolute position display pattern according to the present invention will now be described.
- [93] Error correction requires that 2-bit binary data be encoded and displayed at second cells 402 of the above-mentioned direction window 403 for distinguishing a window in a manner different from that of first cells 401. The 2-bit values become the error correcting codes for X and Y coordinates, respectively. The error correcting code for X coordinates functions independent of that for Y coordinates, but in the same manner. Therefore, the error correction code for X coordinates will solely be described for clarity.
- [94] A 4x4 window contains 13-bit information regarding X coordinates. However, 2-bit error correction requires at least 6 redundant bits. The RS (Reed-Solomon) code, which is the optimal algorithm for block codes, has the code type of $(2^k-1, 2^k-1-k)$. Therefore, (2^k-1-k) -bit data can be reconstructed into a (2^k-1) -bit codeword to correct errors of up to 2 bits. In this case, k refers to the code number for error correction. If $k=4$, 12 of 16 cells are used for data, and the remaining 4 cells are used as error correction codes. To this end, the number of second cells constituting the direction flag 403 must be increased by 1 (i.e. a total of 4). Then, 11 of 12 cells are subjected to error correction,

and the remaining one cell is subjected to error processing by the upper layer.

- [95] A method for correcting bits other than the upper one bit will now be described.
- [96] Second cells constituting a direction flag 403 are reconstructed so that they amount to 4. Respective second cells 402 are encoded by using a type of representation different from that of first cells 401 so that the second cells 402 can contain 2-bit information. The method for calculating the pattern position is the same as mentioned above even if the second cells 402 amount to 4. The only difference is that the number of first cells 401 within the window is reduced by one. Then, RS coding (one of error correction codes) is used to calculate (encode) error correction codes with regard to the entire information (or a part of it) existing in the data cells, and the error correction codes are encoded and displayed at the direction flag cells. If the window is not read accurately, but obliquely, the error correction codes cannot function properly. However, errors can be corrected by calculating the position according to the original position calculation method and conducting RS decoding. It is to be noted that the RS decoding is conducted with regard to estimated codewords, not the original RS-encoded codewords, and that the resulting restoration may not be accurate.
- [97] A method for limitedly correcting the errors of lower bits only will now be described.
- [98] Among binary data constituting a window, bits of higher positional numbers are less likely to change than bits of lower positional numbers. This means that, if error correction is conducted with regard to bits of lower positional numbers, which undergo frequent change, the number of second cells 402 constituting a direction flag can be reduced. As a result, a larger number of different unit cell patterns (windows) 410 can be realized. As mentioned above, the number of cells constituting a direction flag 403 decreases, and the possibility that three cells may not be seen simultaneously is lower than the possibility that four cells may not be seen simultaneously. Therefore, there are more chances that the error correcting function will be conducted as desired.
- [99] Those skilled in the art can easily understand that, although it has been assumed in the above description that RS coding is used to correct errors of an absolute position display pattern, the method is not limited to that type of method.
- [100] Binary data codes displayed at the first and second cells 401 and 402 will now be described.
- [101] FIG. 16 shows exemplary binary data codes displayed at the first cells 401 according to an exemplary embodiment of the present invention. Particularly, assuming that virtual X and Y axes intersect with each other at the center point of each cell, FIG. 16a shows a first line segment lying on the X axis with the intersection point at its center, FIG. 16b shows a second line segment lying on the Y axis with the intersection point at its center, FIG. 16c shows a third line segment lying in the first and

third quadrants with the intersection point at its center, and FIG. 16d shows a fourth line segment lying in the second and fourth quadrants with the intersection point at its center. Each binary data code is displayed by one of the first to fourth line segments.

[102] In other words, respective cells 401 within a unit cell pattern 410 have binary data codes, which represent binary data of respective cells 401. The unit cell pattern 410 expresses its absolute coordinate by using the binary data of respective cells 401 within its region.

[103] FIG. 17 shows a table enumerating the X and Y coordinate values (i.e. binary data) meant by respective line segments (i.e. respective binary data codes) shown in FIG. 16. Particularly, the first line segment shown in FIG. 16a has a meaning value of 0, and the corresponding X and Y coordinates have a value of (1,1). The second line segment shown in FIG. 16b has a meaning value of 1, and the corresponding X and Y coordinates have a value of (0,1). The third line segment shown in FIG. 16c has a meaning value of 2, and the corresponding X and Y coordinates have a value of (1,0). The fourth line segment shown in FIG. 16d has a meaning value of 3, and the corresponding X and Y coordinates have a value of (0,0). Those skilled in the art can understand that the matching between the meaning values and the X and Y coordinate values shown in FIG. 17 is only an example, and can be varied as desired.

[104] FIG. 18 shows exemplary codes of binary data displayed at the second cells 402 according to an exemplary embodiment of the present invention. Particularly, assuming that virtual X and Y axes intersect with each other at the center point of each cell, FIG. 18a shows a first line segment lying in the first and second quadrants in parallel with the X axis, FIG. 18b shows a second line segment lying in the third and fourth quadrants in parallel with the X axis, FIG. 18c shows a third line segment lying in the second and third quadrants in parallel with the Y axis, and FIG. 18d shows a fourth line segment lying in the first and fourth quadrants in parallel with the Y axis. Each binary data code is displayed by one of the first to fourth line segments.

[105] Referring to FIG. 17, the first line segment shown in FIG. 18a has a meaning value of 0, and the corresponding X and Y coordinates have a value of (1,1). The second line segment shown in FIG. 18b has a meaning value of 1, and the corresponding X and Y coordinates have a value of (0,1). The third line segment shown in FIG. 18c has a meaning value of 2, and the corresponding X and Y coordinates have a value of (1,0). The fourth line segment shown in FIG. 18d has a meaning value of 3, and the corresponding X and Y coordinates have a value of (0,0).

[106] As another example of binary data codes displayed at the second cells 402 according to the present invention, line segments may be displayed in the same manner as the first to fourth line segments of first cells 401 shown in FIGs. 16a to 16d, except that they have different lengths to be distinguished from the line segments of the first

cells 401.

- [107] FIG. 19 shows another example of binary data codes displayed at the second cells 402 according to the present invention. Particularly, assuming that virtual X and Y axes intersect with each other at the center point of each cell, FIG. 19a shows a first line segment extending from the intersection point to a point in the first quadrant, FIG. 19b shows a second line segment extending from the intersection point to a point in the second quadrant, FIG. 19c shows a third line segment extending from the intersection point to a point in the third quadrant, and FIG. 19d shows a fourth line segment extending from the intersection point to a point in the fourth quadrant. Each binary data code is displayed by one of the first to fourth line segments, each of which represents a value of X and Y coordinates selected from (0,0), (0,1), (1,0), and (1,1).
- [108] FIG. 20 shows another example of binary data codes displayed at the second cells according to the present invention. Particularly, assuming that virtual X and Y axes intersect with each other at the center point of each cell, FIG. 20a shows a first line segment lying on the positive X and Y axes with the intersection point at its center, FIG. 20b shows a second line segment lying on the negative X axis and on the positive Y axis with the intersection point at its center, FIG. 20c shows a third line segment lying on the negative X and Y axes with the intersection point at its center, and FIG. 20d shows a fourth line segment lying on the positive X axis and on the negative Y axis with the intersection point at its center. Each binary data code is displayed by one of the first to fourth line segments, each of which represents a value of X and Y coordinates selected from (0,0), (0,1), (1,0), and (1,1).
- [109] Various types of line segments have been described as means for encoding binary data displayed at respective cells (first cells 401 or second cells 402) according to the present invention, i.e. as binary data codes. Respective line segments (binary data codes), which have been defined as lines of a predetermined length, may also be expressed as a plurality of points constituting the same straight line. In order to prevent points belonging to a cell from constituting a line segment together with points belonging to an adjacent cell, the maximum distance between points constituting a line segment must always be smaller than the distance between any point belonging to the corresponding cell and other points belonging to an adjacent cell.
- [110] Furthermore, although it has been assumed in the above description that binary data is encoded and displayed at respective cells according to the present invention, the data is not limited to binary data. For example, the data may be based on a numeral system having a radix larger than 2 (e.g. 3 or 4) depending on the number of code types.
- [111] As mentioned above, the digitizer device 200 according to an exemplary embodiment of the present invention includes an input device section, which includes a digital pen 210 and digital paper 220, and a computer system 230 including a

recognition device driver and management software. The digitizer device 200 is configured to transmit the coordinate value of an absolute coordinate or a relative coordinate in a digitizer data format suitable for implementing a digitizer function by the input device section. In addition, absolute and relative coordinates may be properly combined and used to grasp the detailed movement of the digital pen 210 in the digitizer region 222 of the digital paper 220 and obtain a detailed coordinate value.

[112] In this regard, a method for obtaining relative coordinates along the trajectory of a line between absolute coordinates recognized by the digital pen 210 based on an absolute position display pattern on the digital paper 220 will now be described.

[113] Relative coordinates can be extracted in the following two methods.

[114] In the ensuing description, an absolute or relative coordinate refers to a specific point (unit cell pattern) of contact of the digital pen 210 on the digital paper 220, and a coordinate value refers to the numeric value indicated by the absolute or relative coordinate.

[115] FIG. 21 illustrates a method for extracting relative coordinates according to an exemplary embodiment of the present invention, and FIG. 22 illustrates another method for extracting relative coordinates according to an exemplary embodiment of the present invention.

[116] Referring to FIG. 21, in order to extract the coordinate value of a relative coordinate, every value of variation between an absolute coordinate and another absolute coordinate is used (i.e. the value of variation of points between two absolute coordinates is used).

[117] When the digital pen 210 moves from point A to point B, these points A and B correspond to absolute coordinates recognized by the digital pen 210. The digital pen 210 incorporates not only a sensor for recognizing the coordinate value of absolute coordinates (absolute coordinate calculation sensor 330), but also a variation amount calculation sensor 320 to calculate the distance of instantaneous movement of the digital pen 210 and measure the amount of variation ($\delta x, \delta y$) of the coordinate value at every moment. The amount of variation ($\delta x, \delta y$) is added to the coordinate value of point A to obtain the coordinate value of A_1 . The same process is repeated to obtain the coordinate value of points A_2, A_3, A_4 and B. If there is an error between the coordinate value of the absolute coordinate of point B recognized by the digital pen 210 and the coordinate value of point B obtained in this manner, the error is calculated to correct the remaining middle points.

[118] This method can also be used to calculate the coordinate value of point B when the digital pen 210 fails to recognize the absolute coordinate of point B.

[119] FIG. 22 shows an exemplary method of using an absolute coordinate and the direction of movement at the corresponding coordinate. When the digital pen 210

moves from point A to points B and C, the value of slope close to the direction of movement (slope of a tangent) at point A can be calculated by using the amount of variation of the coordinate value between points A and A_1 . Similarly, the slope close to the direction of movement at point B can be calculated by using the amount of variation of the coordinate value between points B and B_1 . Points A and B and the slope at both points may be used to obtain the equation of a suitable curve (e.g. second-order equation) extending through both points, and the coordinate value of points in suitable positions between points A and B can be calculated by using the curve equation.

- [120] In order to measure the amount of variation of a coordinate value by using both methods described with reference to FIGs. 21 and 22, not only the absolute coordinate calculation sensor 330, but also a variation amount calculation sensor 320 for measuring the amount of variation of the coordinate value of an absolute coordinate implement a sensor module of the structure shown in FIG. 23 inside the digital pen 210.
- [121] FIG. 24 illustrates a method for providing a digitizer function by using digital paper and a digital pen according to an exemplary embodiment of the present invention.
- [122] When the digital pen 210 according to an exemplary embodiment of the present invention is connected to the computer system 230, the computer system 230 receives hardware information regarding the digital pen 210 from the installed recognition device driver, and recognizes that the digital pen 230 has been connected to function as a digitizer (S242).
- [123] When the computer system 230 recognizes the digital pen 210 as a digitizer, it sets a digitizer region 222 by using digital paper 220 having an absolute position display pattern, and compares the resolution of the digitizer region 222 with the resolution of the entire monitor 240 or a part of the monitor 240 to be used so that the ratio to be applied to coordinate value conversion is calculated and stored (S244).
- [124] The digitizer region 222 is set in the following manner: the user executes a ratio value setup screen by using the management software, and clicks the rightmost bottom 224 of a portion of the digital paper 220, which is to be used as a digitizer region 222, with the digital pen 210. Then, a quadrangular digitizer region 222 is defined with reference to the corresponding point 224 and the left top vertex of the digitizer paper 220. The resolution of the digitizer region 222 is compared with that of the entire monitor 240 or a portion of the monitor to be used so that the X and Y ratio values are automatically calculated and stored.
- [125] After the digitizer region 222 and coordinate value conversion ratio have been determined, the digital pen 210 provides a digitizer function so that, when the user causes the digital pen 210 to contact the digitizer region 222 on the digital paper 220,

the unit cell pattern 410 in the corresponding position is recognized (S246).

- [126] The digital pen 210 calculates the coordinate value of the absolute coordinate of the recognized unit cell pattern 410. Alternatively, if the user moves the digital pen 210 while it makes contact with the digitizer region 222, the digital pen 210 calculates the amount of variation during the movement and calculates the corresponding coordinate value of the relative coordinate, the absolute coordinate after the movement, etc. (S248).
- [127] A method for calculating the coordinate value of the unit cell pattern 410 recognized by the digital pen 210 will now be described briefly.
- [128] (1) Respective binary data codes (respective line segments) of respective cells 401 and 402 included in the unit cell pattern 401 recognized by the digital pen 210 are recognized;
- [129] (2) binary data (one of (0,0), (1,0), (0,1), and (1,1)) corresponding to respective binary data codes is identified; and
- [130] (3) the binary data of respective cells is combined so that the binary window value of the unit cell pattern 410 (e.g. X coordinate is 0000000000111, Y coordinate is 0000000000011) is used to obtain the coordinate value of the absolute coordinate of the corresponding unit cell pattern (e.g. (0000000000111, 0000000000011)).
- [131] After calculating the coordinate value of the absolute coordinate of the corresponding unit cell pattern 410, the digital pen 210 may subtract the coordinate value from the starting point of the absolute position display pattern (e.g. the left, topmost unit cell pattern of the digital paper 220) to position the corresponding unit cell pattern 410 in the digitizer region 222. To this end, the digital pen 210 according to the present invention pre-stores the coordinate value of the starting point (unit cell pattern) of the absolute position display pattern held by the digital paper 220.
- [132] Assuming that the stored coordinate value of the starting point is (00000000000000, 00000000000000) and that the recognized coordinate value of the unit cell pattern 220 is (0000000000100, 0000000000101), it can be recognized that the corresponding unit cell pattern 220 is displaced from the starting point by four cells in the X axis direction (rightward) and by five cells in the Y axis direction (downward).
- [133] In addition, every moment the user touches the digital paper 220 while the digital pen 210 provides the digitizer function, the digital pen 210 calculates the coordinate value (absolute coordinate and/or relative coordinate) of the corresponding unit cell pattern 410 in real time, converts the coordinate value according to the standard digitizer data format to create a digitizer coordinate value, and transmits it to the computer system 230 (S250, S252).
- [134] The recognition device driver of the computer system 230 converts the coordinate value of the standard digitizer data format, which is transmitted from the digital pen

210, according to the screen ratio of the monitor 240 based on the coordinate value conversion ratio set by the management software (S254). Then, the driver transfers the converted coordinate value to various digitizer applications of the computer system 230, and outputs the created resultant via the monitor 240 (S256).

[135] Although it has been assumed in the above description that the digital pen 210 calculates the coordinate value of absolute and relative coordinates of the unit cell pattern 410, converts the calculated coordinate value into a digitizer coordinate value, and transmits it to the computer system 230, this construction is only an example, and does not limit the present invention. It is also possible to transfer information regarding the absolute position display pattern of the unit cell pattern 410 recognized by the digital pen 210 to the computer system 230, to calculate the coordinate value of the absolute coordinate and/or relative coordinate of the unit cell pattern 410 by the recognition device driver and management software of the computer system 230, and to convert the coordinate value into a digitizer coordinate value of the standard digitizer data format.

[136] FIG. 25 illustrates how to set a digitizer region 220 by a digitizer device 200 according to the present invention, and FIG. 26 illustrates how the user can use the digitizer function provided by the digitizer device 200 according to an exemplary embodiment of the present invention.

[137] FIG. 27 shows exemplary digital paper according to an exemplary embodiment of the present invention, and FIGS. 23-31 show exemplary setup screens for providing a digitizer function by a digitizer device according to an exemplary embodiment of the present invention.

[138] Referring to FIG. 27, the digital paper 220 according to the present invention is placed on a separate tablet, and buttons (regions) are created on the digital paper 220 to be used for specific functions. Regions corresponding to respective buttons may be implemented by repeatedly printing unit cell patterns 410 corresponding to coordinate values within a specific range or unit cell patterns 410 corresponding to specific coordinate values.

[139] FIG. 28 shows a screen for setting various functions of the digital pen 210 for providing a digitizer function. Buttons 602 can be used to set the pressure sensitivity of the digital pen 210. More particularly, if the sensitivity of the pen point is set to be "SMOOTH", the digital pen 210 adds a predetermined amount of pressure to the actual pressure value so that a pressure value higher than the actual pressure value is transmitted to the computer system 230. This means that the majority of transmitted pressure values is high. If the sensitivity setting is "MEDIUM", uniformly distributed pressure values (ranging from low to high) are transmitted. If the sensitivity setting is "HARD", the digital pen 210 subtracts a predetermined amount of pressure from the

actual pressure value so that a pressure value lower than the actual pressure value is transmitted to the computer system 230. This means that the majority of transmitted pressure values is low. Such pressure value setup makes it possible to adjust the gray level of colors of the resultant outputted by the digitizer function, the thickness of lines, etc. It is also possible to adjust both the gray scale and thickness.

- [140] Buttons 604 enable the user to set buttons of the digital pen 210. Particularly, a number of buttons of the digital pen 210 are assigned various functions, which are to be conducted when the user press the corresponding buttons, including double clicks, right/left clicks, ending programs, switching between the mouse and digital pen 210, erasers, opening files or folders, etc.
- [141] FIG. 29 shows a method for matching the screen ratio, direction, etc. for providing a digitizer function. The button 606 enables the user to set the direction of the digital paper 220. Particularly, the direction of the digital paper 220 that can be set by the button 606 includes normal (forward), leftward or rightward 90° rotation, 180° rotation, 270° rotation, etc.
- [142] The button 608 enables the user to set the communication mode. Particularly, the user can decide whether to use the digital pen 210 as the input means of the computer system 230 (pen mode) or other means, such as the mouse (mouse mode). If the pen mode is selected, the digital pen 210 according to the present invention either provides a digitizer function or provides a pen-type input means.
- [143] The button 610 enables the user to set a region on the monitor screen. Particularly, when a digitizer function is provided in the pen mode, the user can decide whether to match the digitizer region 222 of the digital paper 220 with the entire monitor screen at the ratio of 1:1 or match the digitizer region 222 with only a part of the monitor screen. In the latter case, a separate setup screen (FIG. 30) may be additionally provided so that the user can set a specific region on the monitor screen. The button 612 enables the user to set a region on the digital paper 220. Particularly, the user can decided whether to match the entire region of the digital paper 220 with the region set on the monitor at the ratio of 1:1 or match only a partial region of the digital paper 220 with the region set on the monitor. In the latter case, a separate setup screen may be additionally provided so that the user can set a specific region (digitizer region 222) on the digital paper 220.
- [144] FIGs. 30 and 31 show screens for setting regions to be used on the monitor and the digital paper 220 to provide a digitizer function.
- [145] Particularly, the setup screen 614 is used to set a specific region with regard to the virtual monitor shape. The button 614 is used to click the "START" button and set a region on a part of the actual monitor screen by using the mouse. The setup screen 618 is used to manually input the resolution value of the desired region to be used

according to the monitor resolution so that a region can be set on a part of the monitor to match with the digitizer region 222 of the digital paper 220. The setup screen 620 is used to set a specific region with regard to the virtual digital paper shape. The button 622 is used to click the "START" button and set a specific region by clicking the left top point and the right bottom point of a region to be used on the actual digital paper 220 by using the digital pen 210. The setup screen 624 is used to manually input the coordinate value of a region to be used within the range of maximum input values corresponding to the upper, lower, left, and right limits of the digital paper 220 so that so that a region is set on a part of the digital paper 220 to match with the region set on the monitor screen. The maximum input values corresponding to the upper, lower, left, and right limits of the digital paper 220 may be provided by default on the setup screen 624.

- [146] Although several exemplary embodiments of the present invention have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Industrial Applicability

- [147] As mentioned above, according to the present invention, a digitizer function is provided by using a digitizer device using digital paper and a digital pen so that more users are provided with universal digitizer input devices that are easily carried and inexpensive.
- [148] In addition, the inventive device can easily implement functions that are difficult to conduct by conventional mice, e.g. drawing pictures or writing small letters on the computer. This guarantees real-time implementation of various functions on line, including chatting, handwriting mail, tutorial correction, etc.

Claims

- [1] A digitizer device for providing a digitizer function, comprising:
digital paper having an absolute position display pattern printed thereon;
a recognition means for recognizing the absolute position display pattern on the digital paper;
a conversion means for calculating a coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern of the absolute position display pattern and converting the coordinate value according to a standard digitizer data format to create a digitizer coordinate value; and
an application means for converting the digitizer coordinate value according to a screen ratio value, creating a resultant by a digitizer application, and outputting the resultant.
- [2] The digitizer device as claimed in claim 1, wherein the absolute position display pattern comprises:
first cells displaying encoded data expressed by a numeral system having a radix of 2 or a larger number;
second cells displaying encoded data in a manner distinguished from the first cells or having no data; and
a unit cell pattern comprising at least a predetermined number of first and second cells,
a combination of data corresponding to the first cells within the unit cell pattern indicates the absolute coordinate of the corresponding unit cell pattern, and the unit cell pattern is separated and distinguished from other adjacent unit cell patterns by the second cells within the unit cell pattern.
- [3] The digitizer device as claimed in claim 2, wherein the unit cell pattern comprises NxM (N and M are integers, N=M or N≠M) cells.
- [4] The digitizer device as claimed in claim 2, wherein respective positions of the first cells within the unit cell pattern indicate positional numbers of data indicating a value of the absolute coordinate.
- [5] The digitizer device as claimed in claim 2, wherein the number of the second cells within the unit cell pattern is equal to or larger than 3, and the second cells are joined by line segments of a type having no rotational symmetry.
- [6] The digitizer device as claimed in claim 2, wherein errors of the absolute coordinate are corrected by using a value of data corresponding to the second cells within the unit cell pattern.
- [7] The digitizer device as claimed in claim 2, wherein each X coordinate of the

- absolute coordinate of unit cell patterns in an identical row has a value gradually increasing by 1 in a rightward or leftward horizontal direction, and each Y coordinate of the absolute coordinate of unit cell patterns in an identical column has a value gradually increasing by 1 in an upward or downward vertical direction.
- [8] The digitizer device as claimed in claim 2, wherein each X coordinate of the absolute coordinate of unit cell patterns in an identical row has a constant value, and each Y coordinate of the absolute coordinate of unit cell patterns in an identical column has a constant value.
- [9] The digitizer device as claimed in claim 1, wherein the input means comprises:
an optical system/lens for optically inputting at least one unit cell pattern;
an absolute coordinate calculation sensor for recognizing an image of the inputted unit cell pattern;
a microcontroller for processing information inputted from the absolute coordinate calculation sensor;
an internal memory for storing predetermined information under the control of the microcontroller and storing information regarding the standard digitizer data format; and
a USB interface for communicating with the application means under the control of the microcontroller.
- [10] The digitizer device as claimed in claim 9, wherein the input means further comprises a variation amount calculation sensor for measuring the amount of variation of the coordinate value of the absolute coordinate.
- [11] The digitizer device as claimed in claim 10, wherein the microcontroller is adapted to calculate the coordinate value by using information inputted from the variation amount calculation sensor and the absolute coordinate calculation sensor, convert the coordinate value according to the standard digitizer data format, and transmit the converted coordinate value to the application means.
- [12] The digitizer device as claimed in claim 10, wherein the microcontroller is adapted to calculate the absolute coordinate of the unit cell pattern and calculate the relative coordinate by using the amount of variation of the absolute coordinate measured by the variation amount calculation sensor.
- [13] The digitizer device as claimed in claim 9, wherein the absolute coordinate calculation sensor is adapted to calculate the coordinate value of the absolute coordinate by using the image of the unit cell pattern.
- [14] The digitizer device as claimed in claim 9, wherein, when the input means moves from a first absolute coordinate (A) to a second absolute coordinate (B), the microcontroller calculates the distance of instantaneous movement of the input

means to measure the amount of coordinate variation ($\delta x, \delta y$) at every moment, adds ($\delta x, \delta y$) to the first absolute coordinate (A) to obtain a coordinate value of a first relative coordinate (A_1), and repeats identical processes to obtain coordinate values of following relative coordinates (A_2, A_3, A_4) and the second absolute coordinate (B).

- [15] The digitizer device as claimed in claim 9, wherein, when the input means moves from a first absolute coordinate (A) to a second absolute coordinate (B) and a third absolute coordinate (C), the microcontroller calculates a slope value close to a movement direction (slope of a tangent) at the first absolute coordinate (A) by using the amount of coordinate variation between the first absolute coordinate (A) and a relative coordinate (A_1), calculates a slope close to a movement direction at the second absolute coordinate (B) by using the amount of coordinate variation between the second absolute coordinate (B) and a relative coordinate (B_1), obtains an equation of a suitable curve extending through two points by using the slopes at the first absolute coordinate (A) and the second absolute coordinate (B), and calculates coordinate values of points in suitable positions between the first absolute coordinate (A) and the second absolute coordinate (B) by using the equation.
- [16] The digitizer device as claimed in claim 1, wherein the application means comprises:
a USB input/output means for receiving the digitizer coordinate value from the input means and the conversion means;
a central processing unit for controlling reception, management, conversion, and output of the digitizer coordinate value;
a storage means for storing at least one of a recognition device driver and management software; and
a monitor for outputting the resultant created from the digitizer coordinate value.
- [17] The digitizer device as claimed in claim 16, wherein, when the input means is connected to the application means, the recognition device driver provides hardware information so that the application means recognizes the input means as a standard digitizer, manages the digitizer coordinate value transmitted from the input means so that the digitizer coordinate value is converted by applying a screen ratio value set by the management software, and transmits the converted digitizer coordinate value to a digitizer application.
- [18] The digitizer device as claimed in claim 16, wherein, when the user executes a screen ratio value setup screen by using the management software and clicks a rightmost bottom point of a portion on the digital paper to be used as a digitizer region by the input means, the management software designates a quadrangle as

the digitizer region, the quadrangle being defined with reference to the clicked point and a left top vertex of the digital paper, and compares resolution of the digitizer region with resolution of the entire monitor or a part of the monitor to be used so that a screen ratio value is automatically calculated and stored, the screen ratio value comprising a X ratio value and a Y ratio value to be applied for conversion of the digitizer coordinate value.

- [19] A method for providing a digitizer function by a digitizer device comprising digital paper having an absolute position display pattern printed thereon, a recognition means for recognizing the absolute position display pattern, a conversion means for calculating a coordinate value and converting the coordinate value to create a digitizer coordinate value, and an application means for outputting a resultant by using the digitizer coordinate value, the method comprising the steps of:
- (a) recognizing the absolute position display pattern by the recognition means;
 - (b) calculating the coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern of the absolute position display pattern and converting the coordinate value according to a standard digitizer format to create the digitizer coordinate value by the conversion means; and
 - (c) receiving the digitizer coordinate value, converting the digitizer coordinate value according to a screen ratio value, creating the resultant through a provided digitizer application, and outputting the resultant by the application means.
- [20] The method as claimed in claim 19, wherein the method further comprises, prior to step (a), the steps of:
- (a-1) receiving hardware information regarding the input means from a recognition device driver and recognizing the input means as a standard digitizer by the application means when the input means is connected to the application means;
 - (a-2) receiving a specific coordinate value of a portion to be used as a digitizer region from the input means by the application means, the coordinate value being inputted by the user while a ratio value setup screen of management software is being executed;
 - (a-3) designating a quadrangle as the digitizer region by the application means, the quadrangle being defined with reference to the specific coordinate value and a left top vertex of the digital paper; and
 - (a-4) comparing resolution of the digitizer region with resolution of the entire monitor of the application means or a part of the monitor to be used so that a screen ratio value is calculated and stored, the screen ratio value comprising a X

- ratio value and a Y ratio value to be applied for conversion of the digitizer coordinate value, by the application means.
- [21] The method as claimed in claim 19, wherein step (a) comprises the steps of:
 (a1) calculating the absolute coordinate of the unit cell pattern by the conversion means when the input means contacts the digitizer regions and when the unit cell pattern in a corresponding position is recognized;
 (a2) calculating the amount of variation resulting from movement and calculating the relative coordinate and an absolute coordinate after the movement by the conversion means when the input means moves in a specific direction while making contact with the digitizer region; and
 (a3) converting the coordinate value of the absolute coordinate and the relative coordinate in real time according to a standard digitizer data format and transmitting the converted coordinate value to the application means by the conversion means.
- [22] The method as claimed in claim 19, wherein step (c) comprises the steps of:
 (c1) converting the digitizer coordinate value transmitted from the conversion means to conform to a monitor screen ratio according to a screen ration value set by management software by the application means by using a provided recognition device driver; and
 (c2) outputting the resultant created from the digitizer coordinate value via the monitor by the application means by using a provided digitizer application.
- [23] An input device for providing a digitizer function, comprising:
 an optical system/lens for optically inputting at least one unit cell pattern;
 an absolute coordinate calculation sensor for recognizing an image of the unit cell pattern and calculating a coordinate value of an absolute coordinate;
 a microcontroller for processing information inputted from the absolute coordinate calculation sensor, calculating a relative coordinate by using the amount of variation of the absolute coordinate, and converting the coordinate value of the absolute coordinate and the relative coordinate according to a standard digitizer data format to create a digitizer coordinate value;
 an internal memory for storing predetermined information under the control of the microcontroller and storing information regarding the standard digitizer data format; and
 a USB interface for communicating with the application means under the control of the microcontroller.
- [24] The input device as claimed in claim 23, further comprising a variation amount calculation sensor for measuring the amount of variation of the coordinate value of the absolute coordinate.

- [25] The input device as claimed in claim 24, wherein the microcontroller is adapted to calculate the coordinate value of the absolute coordinate and the relative coordinate by using information inputted from the variation amount calculation sensor and the absolute coordinate calculation sensor, convert the coordinate value according to the standard digitizer data format to obtain the digitizer coordinate value, and transmit the digitizer coordinate value to the application means.
- [26] The input device as claimed in claim 25, wherein the microcontroller is adapted to calculate the absolute coordinate of the unit cell pattern and calculate the relative coordinate by using the amount of variation of the absolute coordinate measured by the variation amount calculation sensor.
- [27] The input device as claimed in claim 23, wherein, when the input device moves from a first absolute coordinate (A) to a second absolute coordinate (B), the microcontroller calculates the distance of instantaneous movement of the input device to measure the amount of coordinate variation ($\delta x, \delta y$) at every moment, adds ($\delta x, \delta y$) to the first absolute coordinate (A) to obtain a coordinate value of a first relative coordinate (A_1), and repeats identical processes to obtain coordinate values of following relative coordinates (A_2, A_3, A_4) and the second absolute coordinate (B).
- [28] The input device as claimed in claim 23, wherein, when the input device moves from a first absolute coordinate (A) to a second absolute coordinate (B) and a third absolute coordinate (C), the microcontroller calculates a slope value close to a movement direction (slope of a tangent) at the first absolute coordinate (A) by using the amount of coordinate variation between the first absolute coordinate (A) and a relative coordinate (A_1), calculates a slope close to a movement direction at the second absolute coordinate (B) by using the amount of coordinate variation between the second absolute coordinate (B) and a relative coordinate (B_1), obtains an equation of a suitable curve extending through two points by using the slopes at the first absolute coordinate (A) and the second absolute coordinate (B), and calculates coordinate values of points in suitable positions between the first absolute coordinate (A) and the second absolute coordinate (B) by using the equation.
- [29] The input device as claimed in claim 23, wherein the input device is adapted to identify binary data of respective cells within the unit cell pattern based on binary data codes of the cells and combine the binary data of respective cells to calculate the coordinate value of the unit cell pattern.
- [30] The input device as claimed in claim 23, wherein the input device is adapted to pre-store a coordinate value of a starting point of the absolute position display

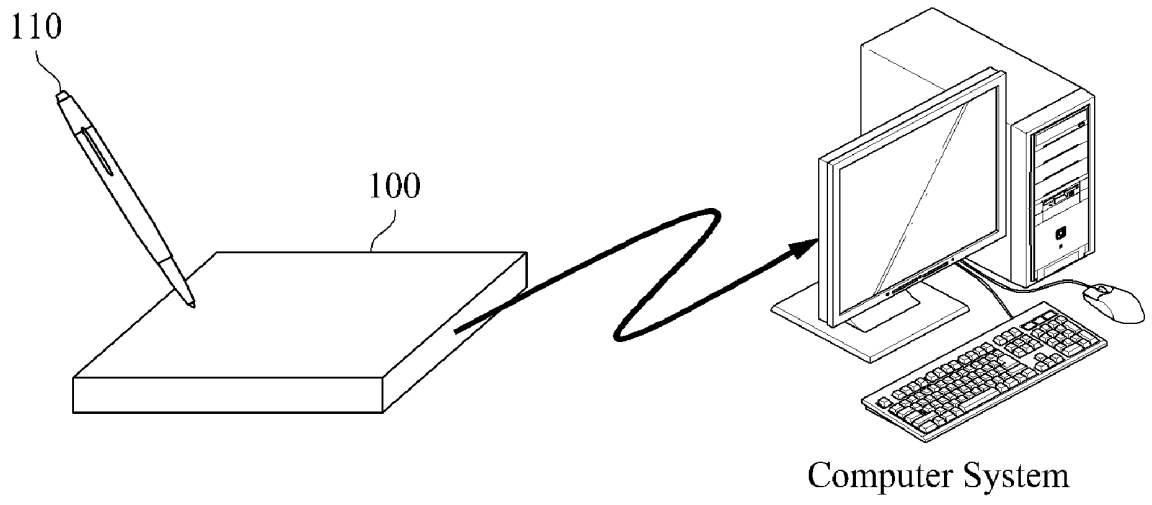
- pattern made up of a number of unit cell patterns and printed on the digital paper.
- [31] The input device as claimed in claim 30, wherein the input device is adapted to subtract a coordinate value of a recognized unit cell pattern from the coordinate value of the starting point to position the recognized unit cell pattern.
- [32] An application device connected to digital paper having an absolute position display pattern printed thereon and to an input device for recognizing the absolute position display pattern on the digital paper so that a digitizer function is provided, the application device comprising:
a USB input/output means for receiving information regarding the absolute position display pattern from the input means;
a central processing unit for driving a recognition device driver and management software to calculate a coordinate value of at least one of an absolute coordinate and a relative coordinate based on binary data held by a unit cell pattern by using the information regarding the absolute position display pattern, converting the coordinate value into a digitizer coordinate value conforming to a standard digitizer data format, and controlling reception, management, conversion, and output of the coordinate value and the digitizer coordinate value;
a storage means for storing at least one of the recognition device driver and the management software for calculating the coordinate value and converting the coordinate value into the digitizer coordinate value; and
a monitor for outputting the resultant created from the digitizer coordinate value.
- [33] The application device as claimed in claim 32, wherein, when the input device is connected to the application device, the recognition device driver provides hardware information so that the application device recognizes the input device as a standard digitizer, manages the coordinate value and the digitizer coordinate value, converts the digitizer coordinate value by applying a screen ratio value set by the management software, and transmits the converted digitizer coordinate value to a digitizer application.
- [34] The application device as claimed in claim 32, wherein, when the user executes a screen ratio value setup screen of the management software and clicks a rightmost bottom point of a portion on the digital paper to be used as a digitizer region by using the input device, the management software designates a quadrangle as the digitizer region, the quadrangle being defined with reference to the clicked point and a left top vertex of the digital paper, and compares resolution of the digitizer region with resolution of the entire monitor or a part of the monitor to be used so that a screen ratio value is automatically calculated and stored, the screen ratio value comprising a X ratio value and a Y ratio value to be applied for conversion of the coordinate value.

- [35] The application device as claimed in claim 32, wherein the recognition device driver and the management software receive the information regarding the absolute position display pattern from the input device, calculate the coordinate value of at least one of the absolute coordinate and the relative coordinate, and convert the coordinate value into the digitizer coordinate value conforming to the standard digitizer data format.

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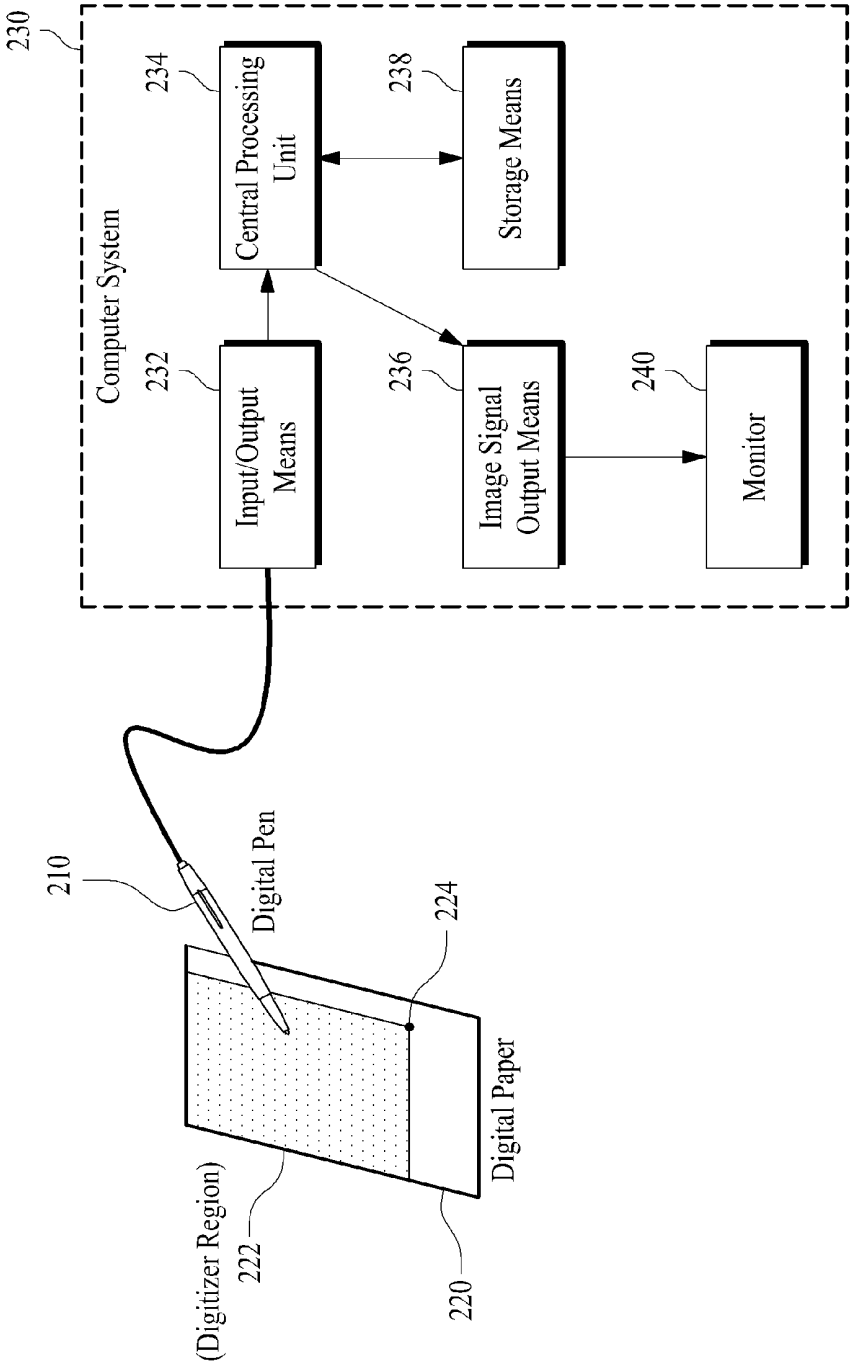
PCT/KR2008/001348

[Fig. 1]



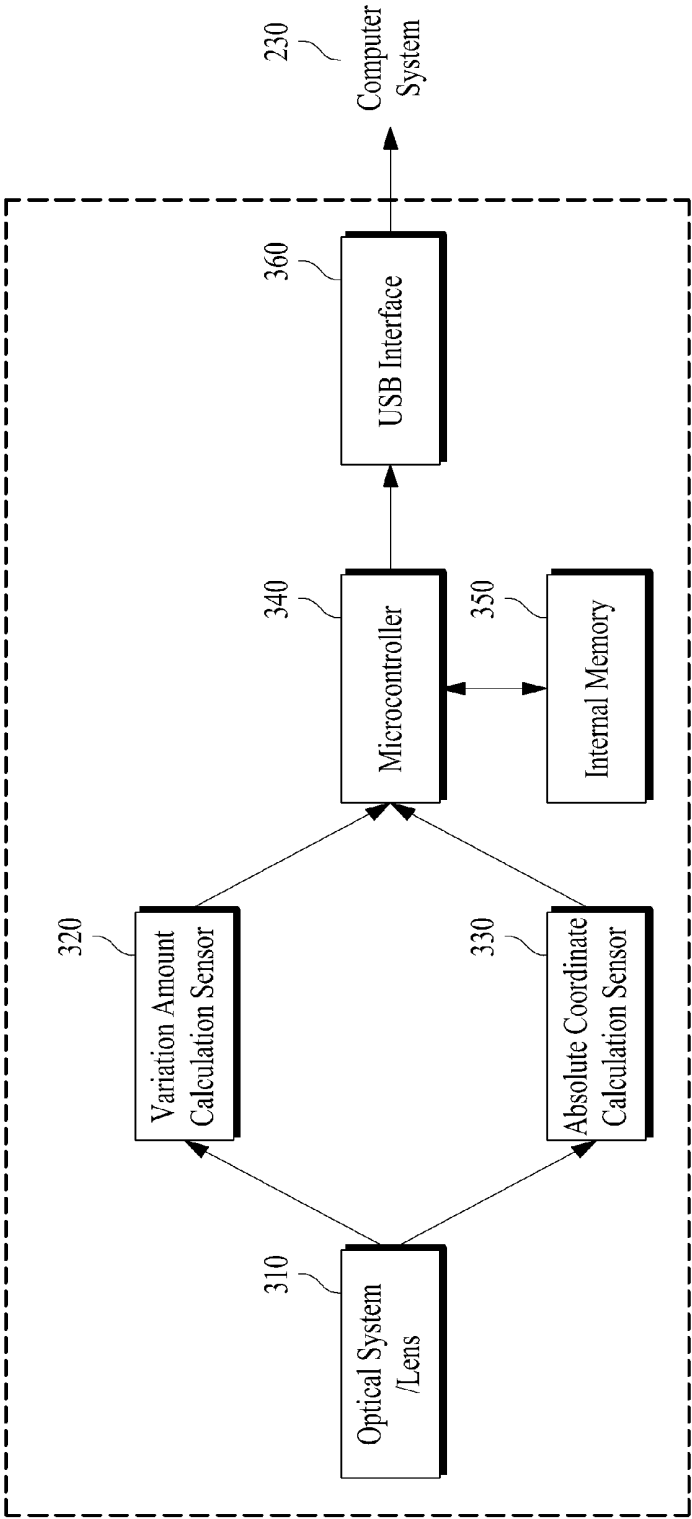
[Fig. 2]

200



[Fig. 3]

210



13	9	5	2
12	8	4	1
11	7	3	
10	6		

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[Fig. 7]

	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	0	0	0		0	0	0		0	0	0		0	0	0	
	0	0			0	0			0	0			0	0		
	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	0	0	0		0	0	0		0	0	0		0	0	0	
	0	0			0	0			0	0			0	0		

[Fig. 8]

1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	
1	1	1		1	1	1		0	0	0		0	0	0		
1	1			1	1			0	0			0	0			

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[Fig. 9]

0	0	0	0
0	0	0	0
0	0	0	
0	0		
0	0	0	0
0	0	0	0
0	0	0	
0	1		
0	0	0	0
0	0	0	0
0	0	0	
1	0		
0	0	0	0
0	0	0	0
0	0	0	
1	1		

[Fig. 10]

13	12	11	10
9	8	7	6
5	4	3	
2	1		

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[Fig. 11]

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0		0	0	0	
0	0			0	0		
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0		0	0	0	
0	1			0	1		
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0		0	0	0	
1	0			1	0		
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0		0	0	0	
1	1			1	1		

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[Fig. 12]

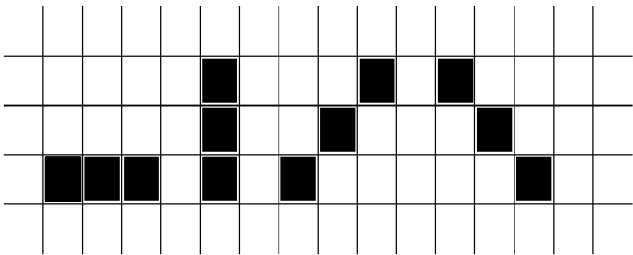
1	1	1	1
1	1	1	1
1	1	1	
1	0		
1	1	1	1
1	1	1	1
1	1	1	
1	1		
0	0	0	0
0	0	0	0
0	0	0	
0	0		
0	0	0	0
0	0	0	0
0	0	0	
0	1		

[Fig. 13]

(x,y)

(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)	(0,0)	(0,0)	(1,0)
(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)
(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■
(0,0)	(0,0)	■	■	(0,0)	(0,0)	■	■	(0,0)	(0,0)	■	■	(0,0)	(0,0)	■	■
(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)	(0,0)	(0,0)	(0,0)	(1,0)
(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)
(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■
(0,0)	(0,1)	■	■	(0,0)	(0,1)	■	■	(0,0)	(0,1)	■	■	(0,0)	(0,1)	■	■
(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)	(0,0)	(0,0)	(0,0)	(1,0)
(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)
(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■
(0,1)	(0,0)	■	■	(0,1)	(0,0)	■	■	(0,1)	(0,0)	■	■	(0,1)	(0,0)	■	■
(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)	(0,0)	(0,0)	(0,0)	(1,0)
(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)
(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■	(0,0)	(0,0)	(0,0)	■
(0,1)	(0,1)	■	■	(0,1)	(0,1)	■	■	(0,1)	(0,1)	■	■	(0,1)	(0,1)	■	■

[Fig. 14]

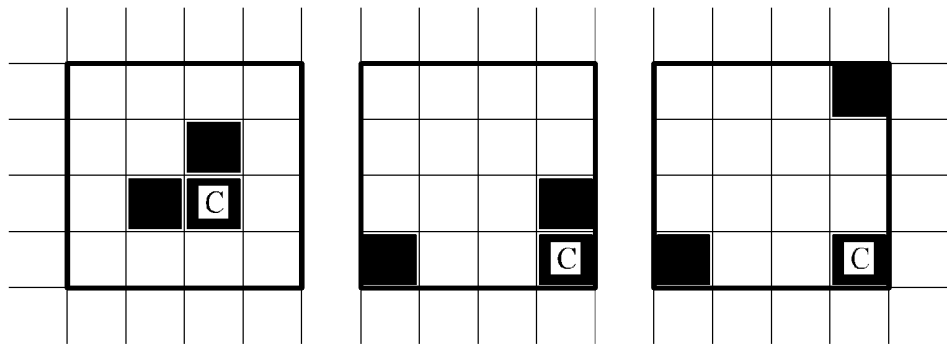


[Fig. 15]

(a)

(b)

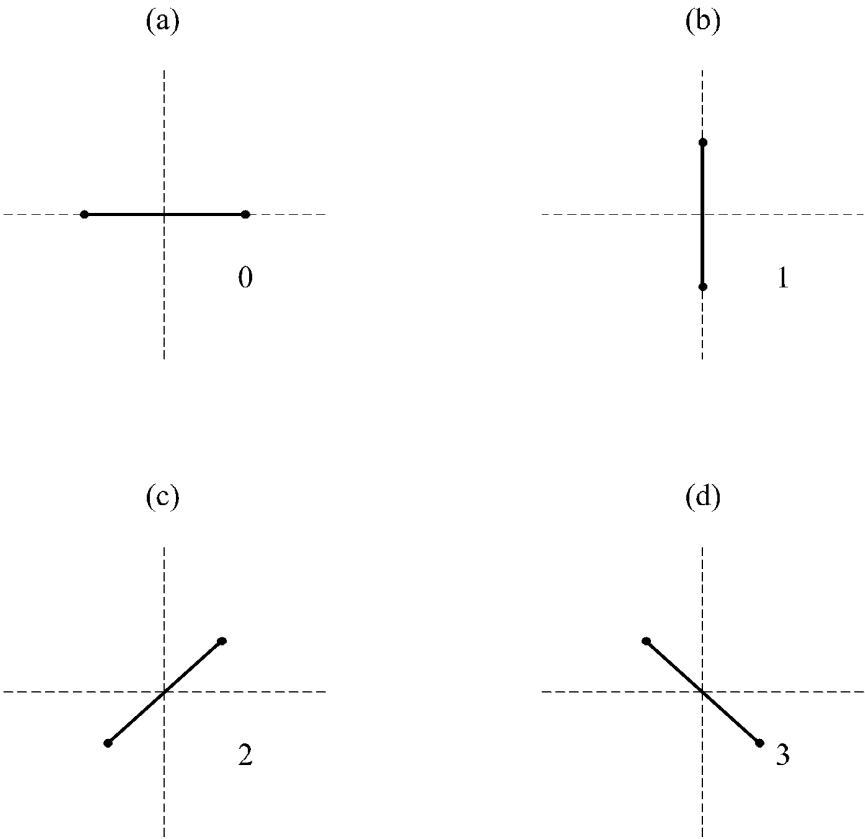
(c)



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[Fig. 16]



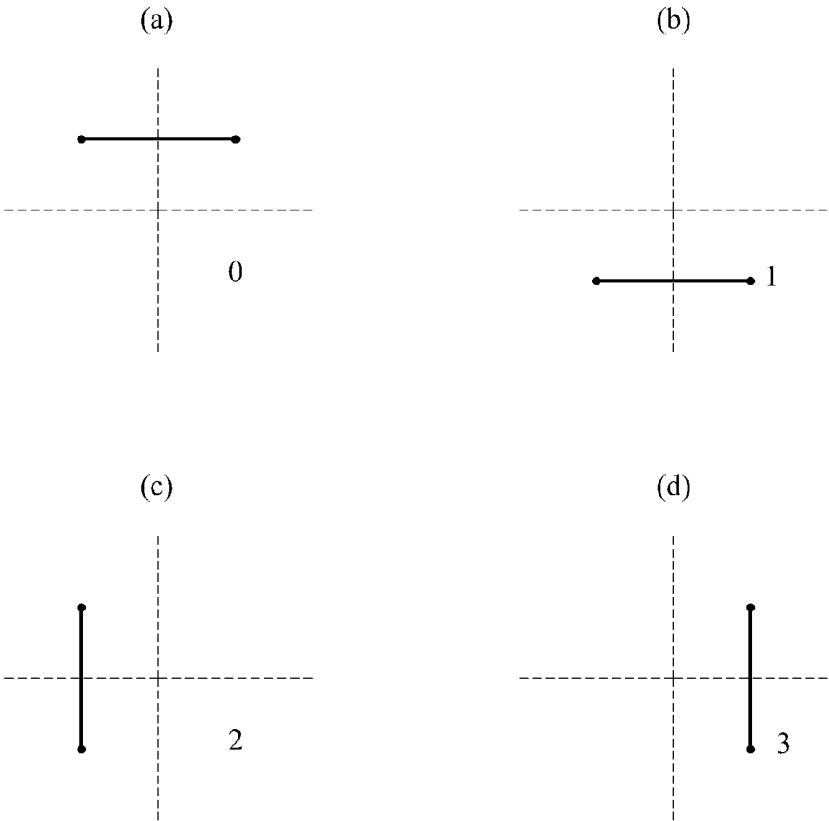
[Fig. 17]

Meaning Value of Code	Value of X Coordinate	Value of Y Coordinate
0	1	1
1	0	1
2	1	0
3	0	0

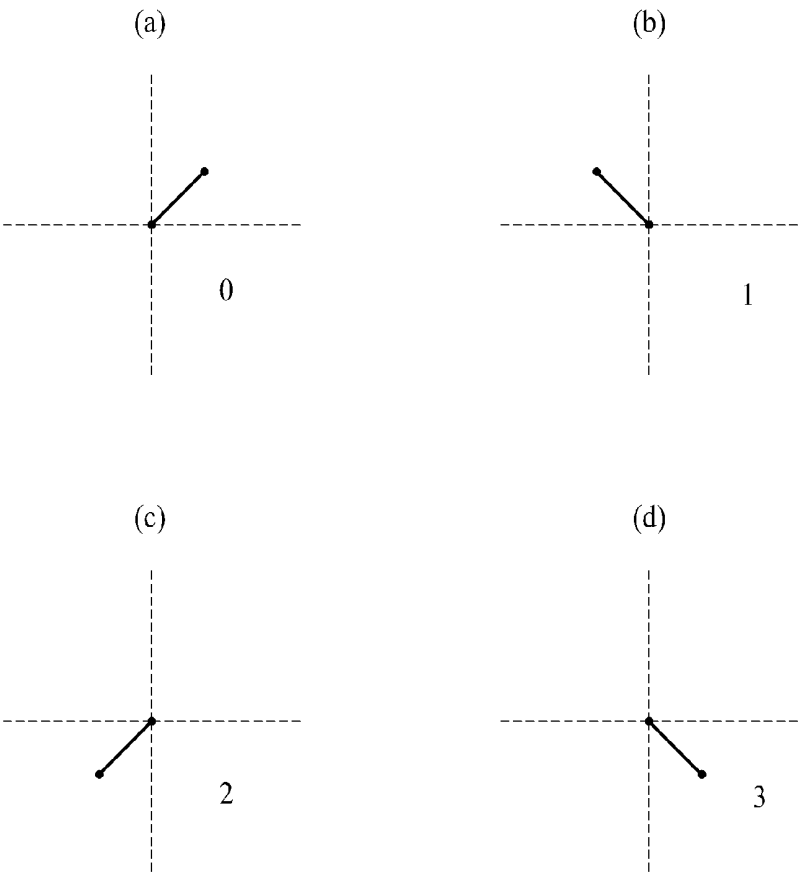
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[Fig. 18]



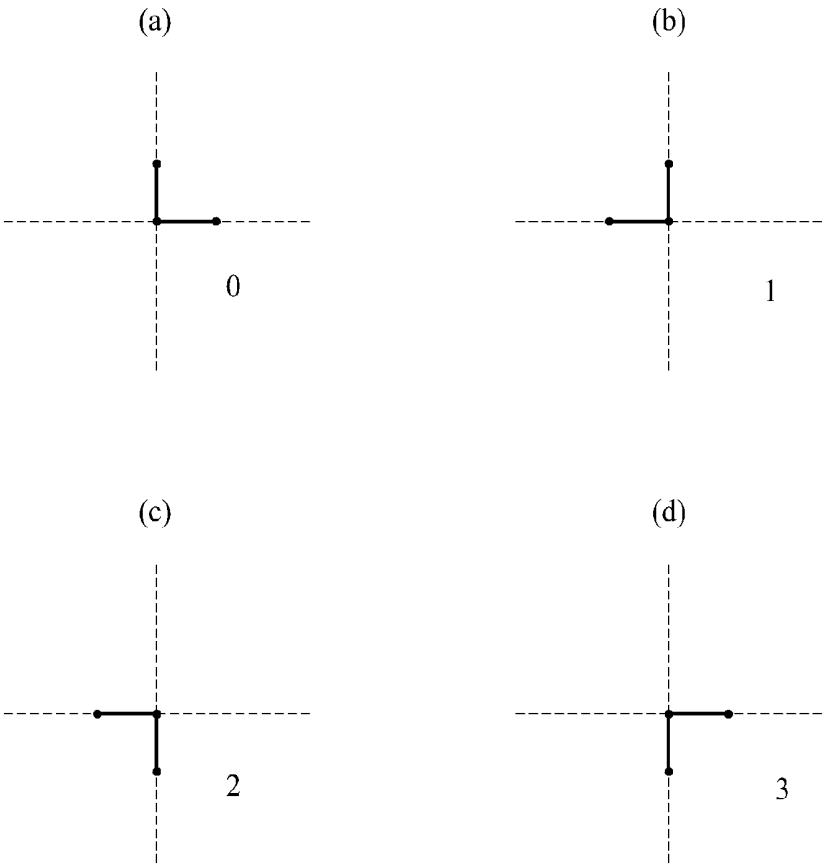
[Fig. 19]



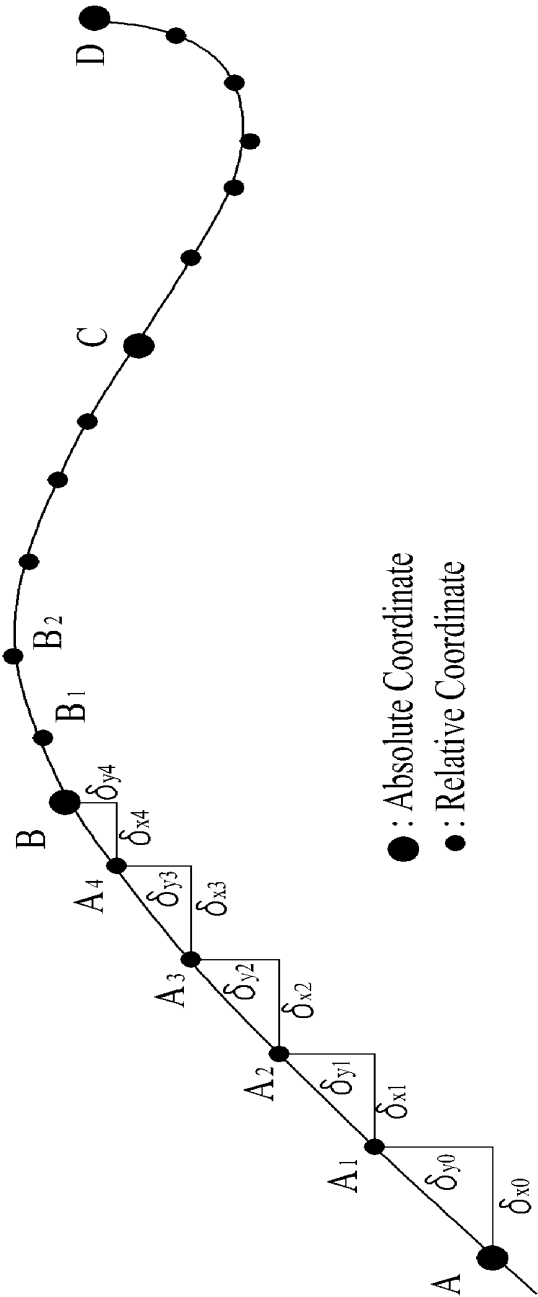
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PCT/KR2008/001348

[Fig. 20]



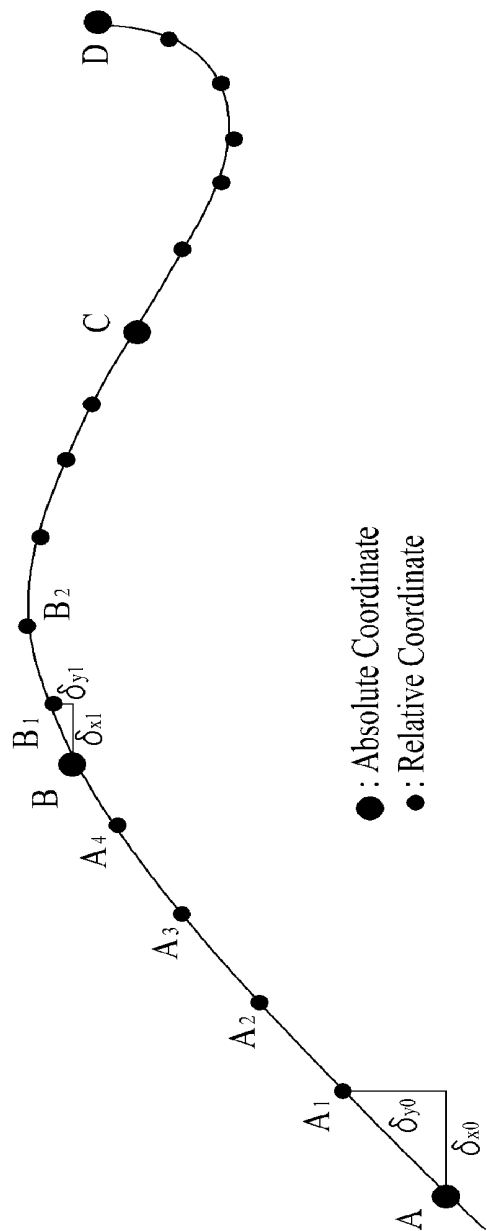
[Fig. 21]



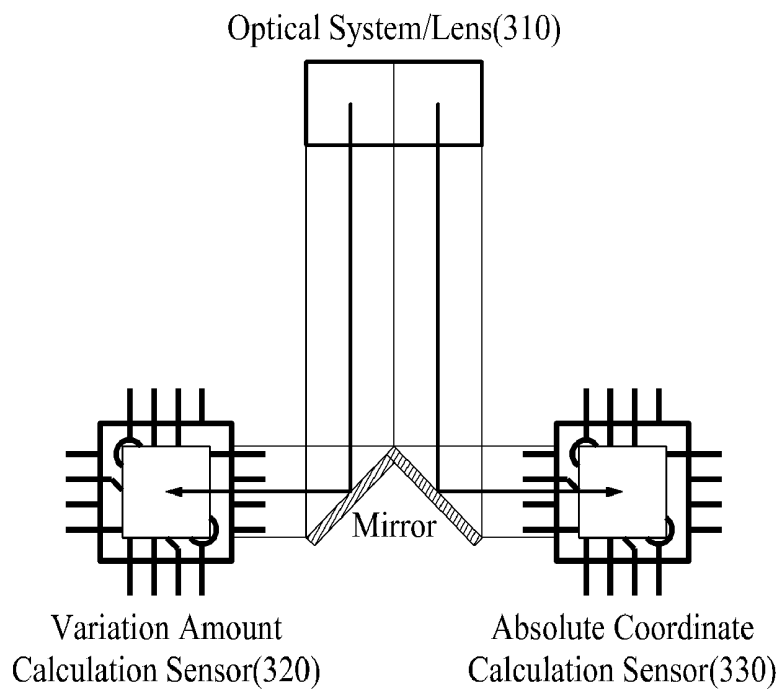
WO 2008/114948

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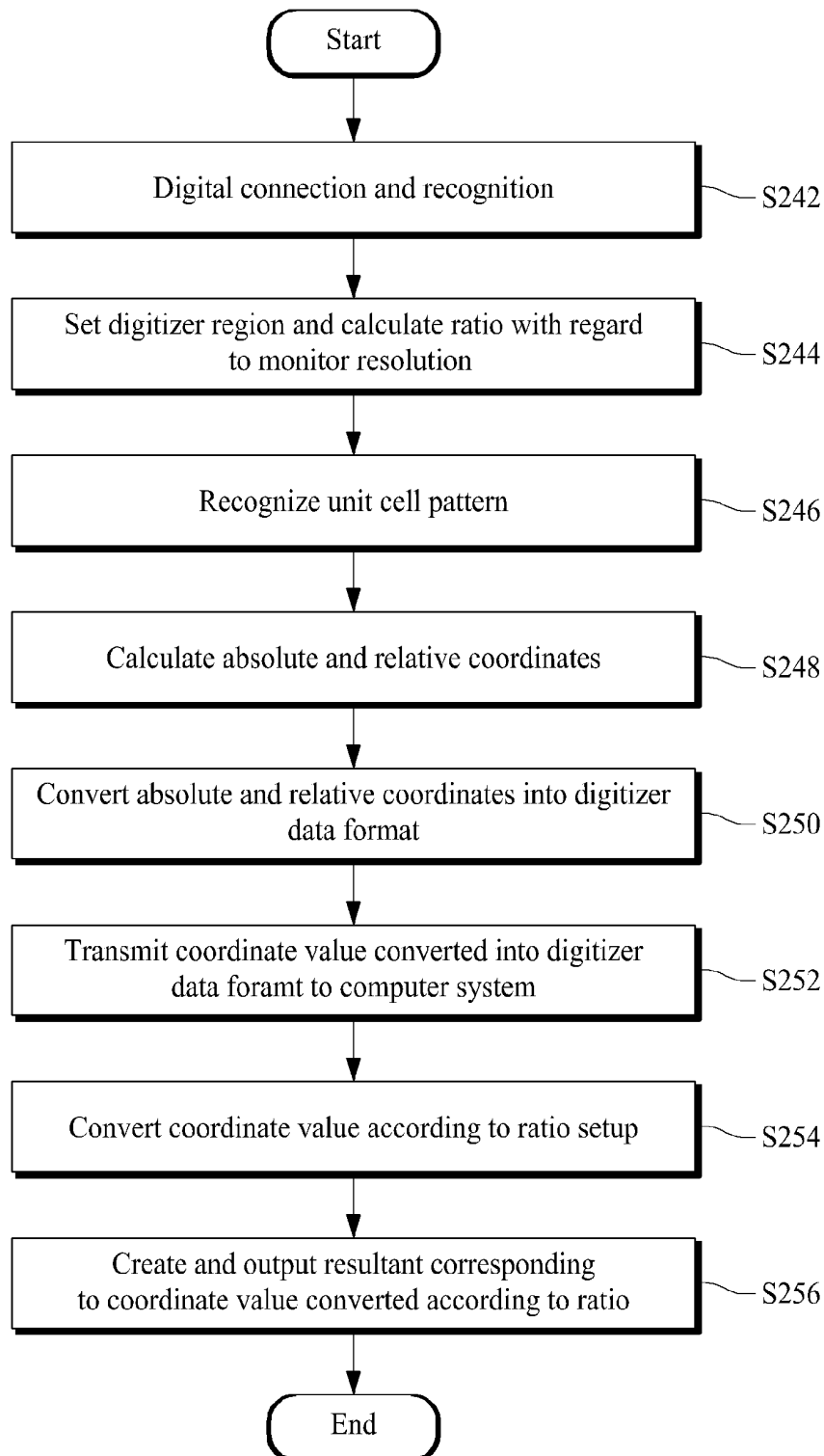
[Fig. 22]



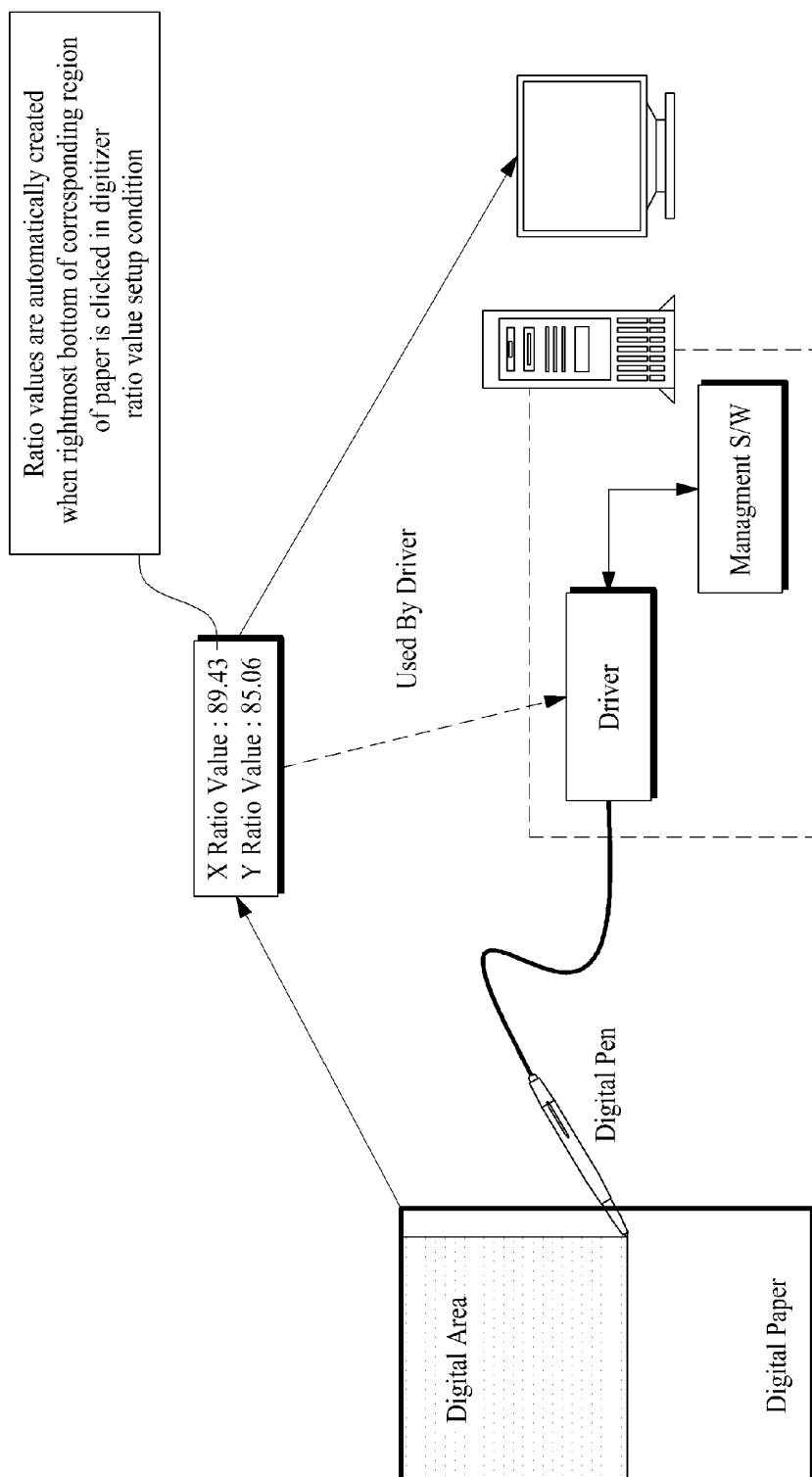
[Fig. 23]



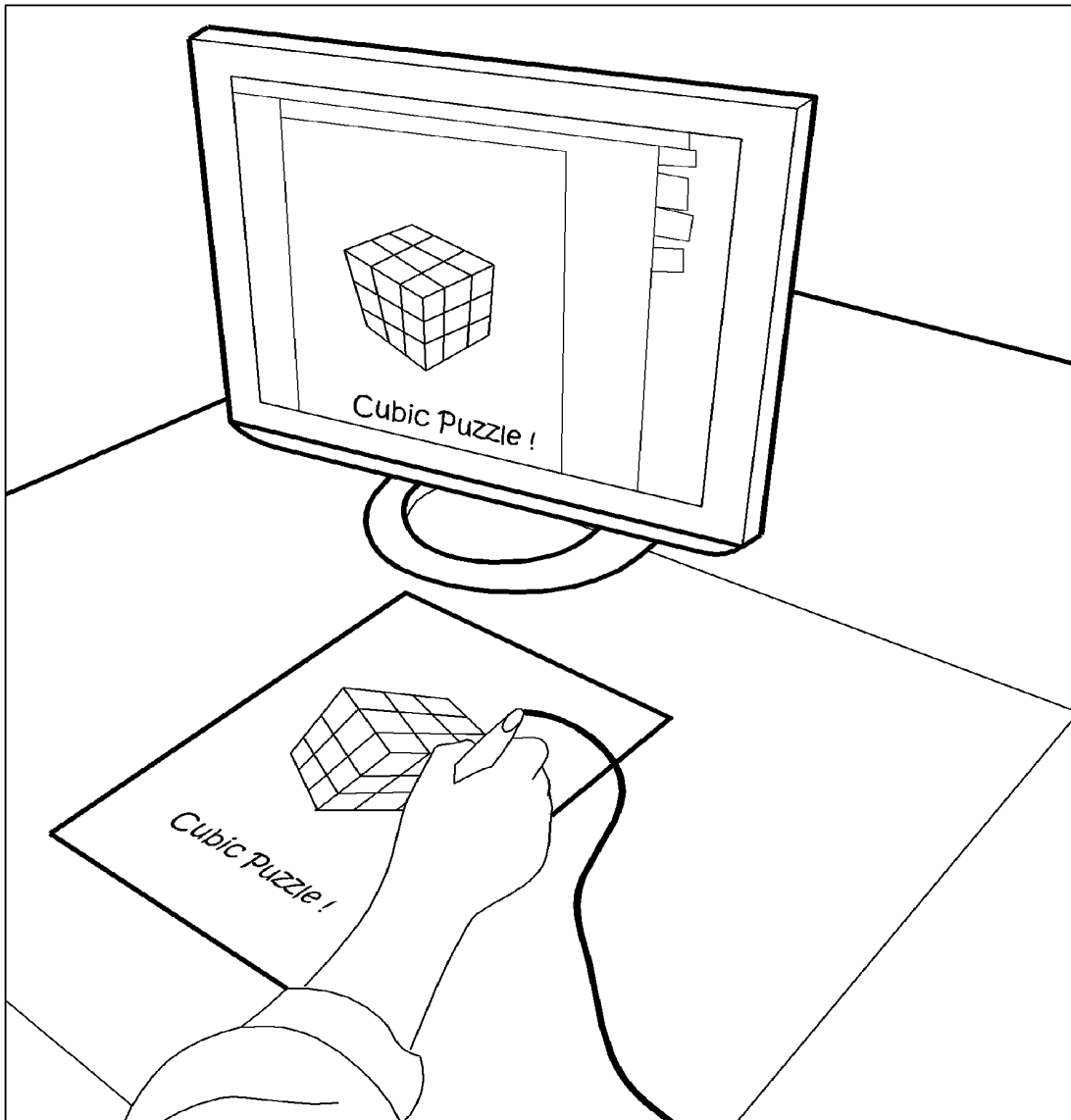
[Fig. 24]



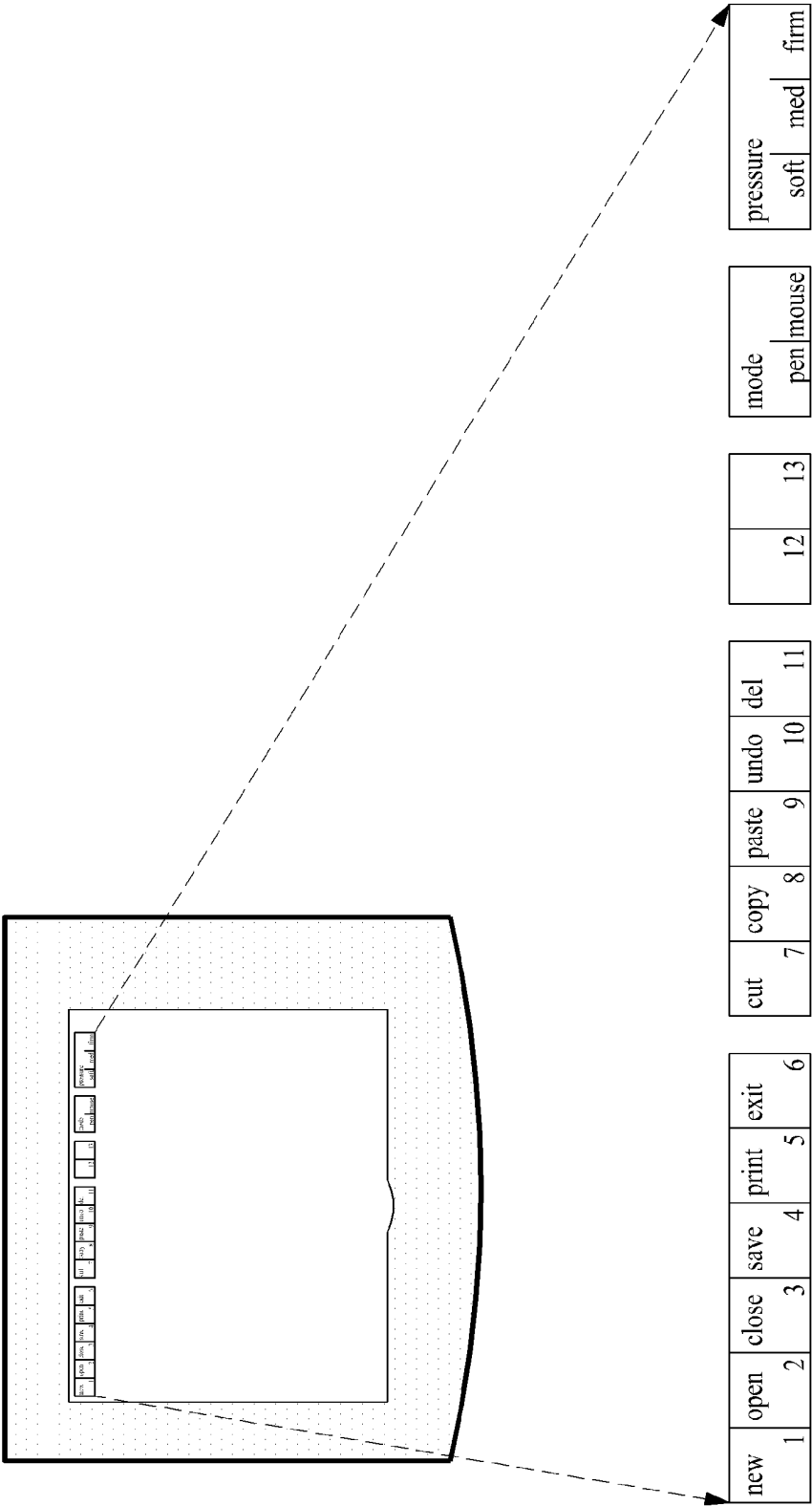
[Fig. 25]



[Fig. 26]



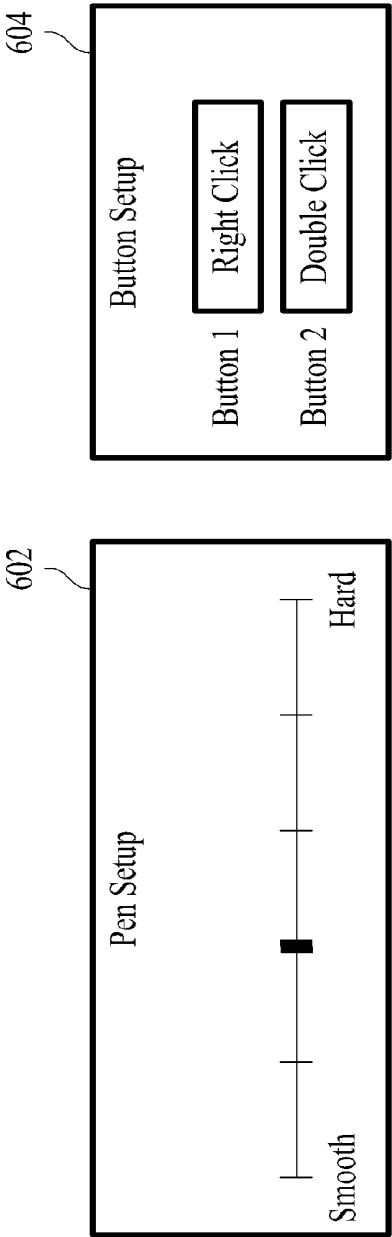
[Fig. 27]



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[Fig. 28]



[Fig. 29]

Paper Direction

Normal

606

Communication Mode

Normal

☒

Mouse

☐

608

Display Region

Variation Amount Calculation Sensor

610

Paper Region

Partial Region

612

[Fig. 30]

Paper display region setup

1. Drag quadrangle

614

2. Click region to use

Start

616

3. Input coordinate (Pixel)

Upper

12

Lower

13

Left

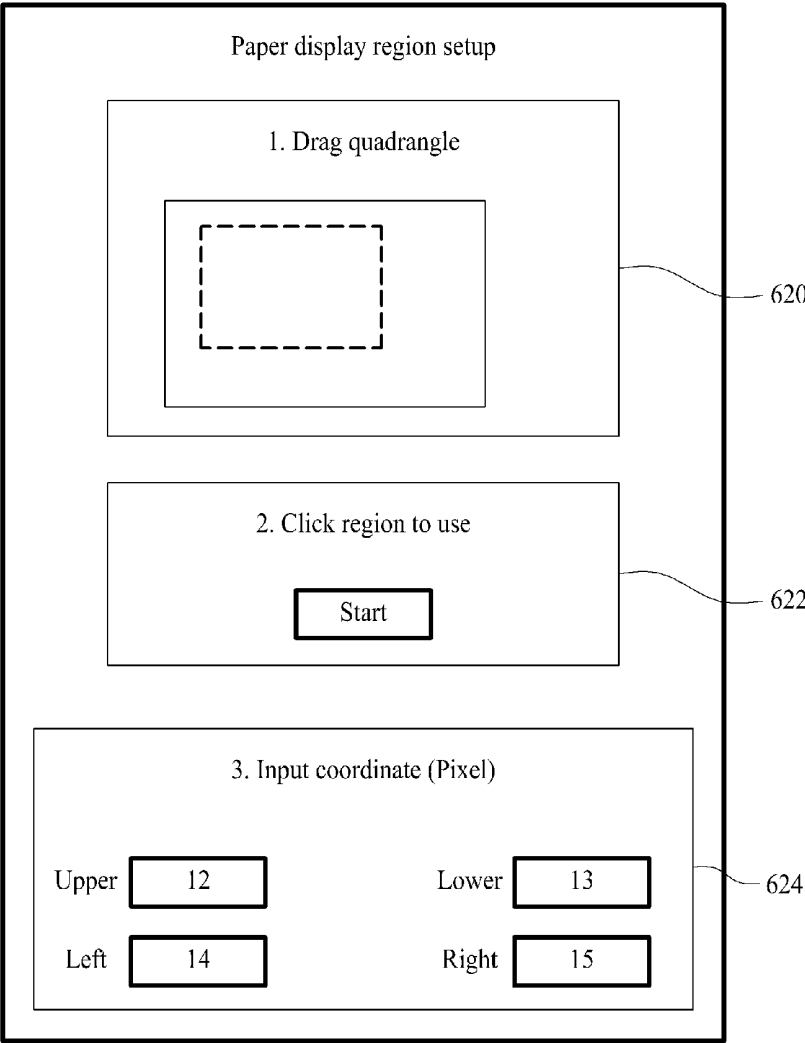
14

Right

15

618

[Fig. 31]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/001348**A. CLASSIFICATION OF SUBJECT MATTER****G06F 3/041(2006.01)i**

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)

IPC 8 : G06F G06K

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

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for Utility models since 1975

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

eKIPASS(KIPO Internal) "pattern", "coordinate"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/065045 A1 (FINGER SYSTEM, INC.) 22 June 2006	1,16,18,19,32,34
Y	See abstract, claims 1, 5 and figures 2-3, 7	2-4, 7-9,13,23,29-31
Y	US 6,663,008 B1 (PETTERSSON et al.) 16 December 2003 See abstract, claim 1 and figures 3-4	2-4, 7-9,13,23,29-31
A	WO 03/060684 A1 (JO, YONG-HO) 24 July 2003 See abstract, claim 1 and figures 3,5	1-35
A	WO 02/21431 A1 (ANOTO AB) 14 March 2002 See abstract, claim 1 and figures 3-4	1-35

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 JUNE 2008 (16.06.2008)

Date of mailing of the international search report

16 JUNE 2008 (16.06.2008)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-
gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

LEE, Cheol Soo

Telephone No. 82-42-481-8525



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/001348

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2006-065045 A1	22.06.2006	EP 1831825 A1 KR 2006066333 A US 2008-0123965 A1	12.09.2007 16.06.2006 29.05.2008
US 6663008 B1	16.12.2003	AU 2000-78218 A1 AU 773011 B2 BR 200014449 A BR 200014676 A CA 2384308 A1 CN 1237470 C CN 1971590 A EP 1222604 A1 EP 1224606 A1 JP 2006-141061 JP 3881365 B2 KR 10-2002-0047206 A KR 10-2007-0039148 A US 7172131 BB US 7248250 BB WO 2001-26032A1 WO 2001-26034A1	10.05.2001 13.05.2004 04.06.2002 18.06.2002 12.04.2001 18.01.2006 30.05.2007 17.07.2002 24.07.2002 01.06.2006 14.02.2007 21.06.2002 11.04.2007 06.02.2007 24.07.2007 12.04.2001 12.04.2001
WO 2003-060684 A1	24.07.2003	AU 2003-235640 A1 KR 10-2003-0062032	30.07.2003 23.07.2003
WO 2002-21431 A1	14.03.2002	AU 2001-46996 A1 AU 2001-46996 A5 CA 2400617 AA CA 2400617 A1 CN 1222905 C CN 1418350 A EP 1317705 A1 EP 1382006 A1 JP 2003-529985 T2 JP 2004-508228 T2 JP 2004-508632 T2 KR 10-2002-0090227 A US 2002-0033414 A1 US 2002-0053596 A1 US 2002-011989 AA WO 2001-75781A1	15.10.2001 15.10.2001 11.10.2001 11.10.2001 12.10.2005 14.05.2003 11.06.2003 21.01.2004 07.10.2003 18.03.2004 18.03.2004 30.11.2002 21.03.2002 09.05.2002 31.01.2002 11.10.2001