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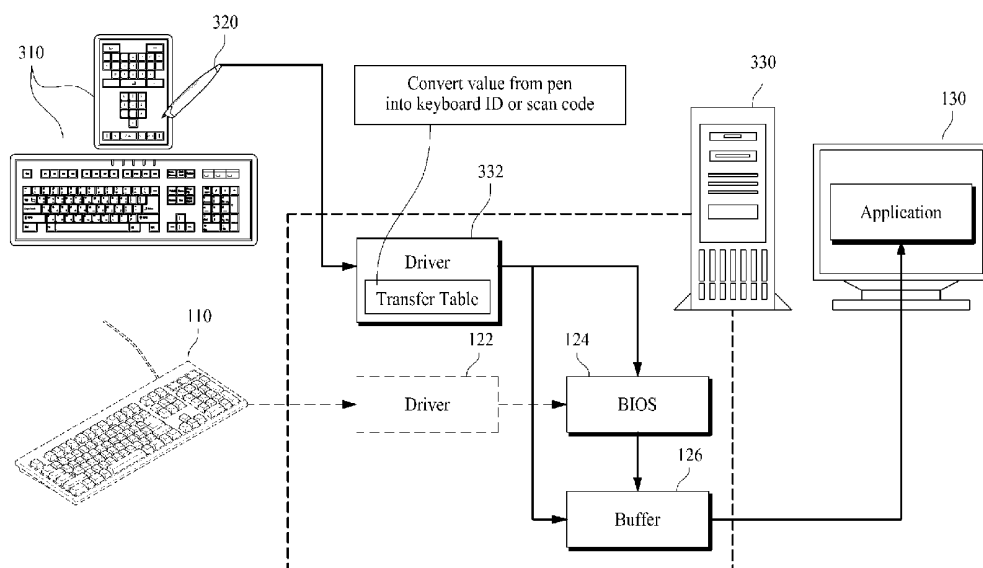
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(54) Title: SYSTEM FOR REALIZING KEYBOARD EMULATOR USING DIGITAL PEN AND DIGITAL PAPER



(57) Abstract: Disclosed is a system for realizing a keyboard emulator using digital paper and a digital pen. The system includes keyboard emulator digital paper, a keyboard emulator/digital pen, and an information communication terminal. Advantageously, a keyboard emulator is realized by using digital paper having a number of X and Y coordinate values or pattern IDs assigned on its surface and a digital pen for recognizing the X and Y coordinate values or pattern IDs printed on the digital paper. The keyboard emulator can be carried conveniently. In addition, the size of the keyboard realized on the digital paper, as well as the number of keys of the keyboard, can be variously selected.

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Description

SYSTEM FOR REALIZING KEYBOARD EMULATOR USING DIGITAL PEN AND DIGITAL PAPER

Technical Field

- [1] The present invention relates to a system for realizing a keyboard emulator using digital paper and a digital pen. More particularly, the present invention relates to a system for emulating functions conducted by the keyboard or keypad of an information communication terminal, including a computer, a PDA, a mobile communication terminal, etc., by using digital paper, which has a number of coordinate values or pattern IDs assigned on the surface, and a digital pen for recognizing the coordinate values or pattern ID assigned to the digital paper.

Background Art

- [2] As generally known in the art, information communication terminals, including computers, PDAs (Personal Digital Assistants), mobile communication terminals, etc., receive instructions or information from the user via an input device, such as a keyboard or a keypad, a digitizer including a touch screen and a tablet, etc.
- [3] The keypad or keyboard (hereinafter, referred to as a keyboard as a whole) is the most widely used input device, and has a number of keys, to which corresponding scan codes are assigned, respectively. Referring to FIG. 1, when the user of an information communication terminal presses a specific key of the keyboard 110, the keyboard 110 transmits a signal corresponding to the specific key, i.e. a specific key input signal, to the information communication terminal 120. The specific key input signal inputted to the information communication terminal 120 is converted into a scan code allocated to the specific key by means of the keyboard driver 122 and BIOS 124, which are installed in the information communication terminal 120. The scan code is temporarily stored in the buffer until it is used by the currently activated application. As used herein, the scan code refers to a code value allocated to each key of the keyboard (or keypad). In general, a scan code is expressed by a four-digit number. The preceding two digits correspond to the combination of left/right Ctrl keys, left/right Shift keys, and left/right Alt keys. The following two digits indicate a unique code value depending on the arrangement of keys of the keyboard 110.
- [4] The size of the keyboard 110 is determined by the number of keys constituting it. Widely used computer keyboards have 106 keys, which make them bulky and inconvenient to carry.
- [5] In order to solve this problem, virtual keyboards using touch screens have been developed together with virtual laser keyboards based on red laser and IR technology.

However, in the case of information communication terminals having a small screen (i.e. PDAs, mobile communication terminals), the limited screen size makes it difficult to display a virtual keyboard using the touch screen concurrently with another application. The virtual laser keyboards must be equipped with a device for generating and recognizing red lasers, which raises the price. In addition, the virtual laser keyboards cannot be used at a narrow place, because they require a space for emitting red lasers as large as the keyboards themselves.

Disclosure of Invention

Technical Solution

- [6] Therefore, the present invention has been made in view of the above-mentioned problems, and the present invention provides a system for emulating functions conducted by the keyboard or keypad of an information communication terminal, including a computer, a PDA, a mobile communication terminal, etc., by using digital paper, which has a number of coordinate values or pattern IDs assigned on the surface, and a digital pen for recognizing the coordinate values or pattern ID assigned to the digital paper.
- [7] In accordance with an aspect of the present invention, there is provided a system for realizing a keyboard emulator by using digital paper and a digital pen, the system including keyboard emulator digital paper including digital paper displaying position display patterns including a number of unit cell patterns, a number of keyboard region coordinate values being assigned to some or all position display patterns of the digital paper; a keyboard emulator/digital pen storing a keyboard region coordinate value range regarding the keyboard region coordinate values so that, when one of the keyboard region coordinate values is recognized from the keyboard emulator digital paper, the keyboard emulator/digital pen confirms that the recognized keyboard region coordinate value belongs to the keyboard region coordinate value range and transmits scan code conversion request information and the keyboard region coordinate value, the scan code conversion request information indicating that the keyboard region coordinate value is a key input of a keyboard or a keypad; and an information communication terminal including a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal receiving the scan code conversion request information and the keyboard region coordinate value from the keyboard emulator/digital pen and converting the keyboard region coordinate value into a scan code of the keyboard or the keypad by means of the keyboard emulator/digital pen driver.
- [8] In accordance with another aspect of the present invention, there is provided a system for realizing a keyboard emulator by using digital paper and a digital pen, the system

including keyboard emulator digital paper including digital paper displaying position display patterns including a number of unit cell patterns, regions of the digital paper being distinguished by coordinate values or pattern IDs assigned to the unit cell patterns, the keyboard emulator digital paper including a specific region of the regions of the digital paper as a keyboard-dedicated region, a number of keyboard region coordinate values corresponding to the dedicated-keyboard region being assigned to the keyboard emulator digital paper; a keyboard emulator/digital pen for recognizing the coordinate value or the pattern ID from the digital paper for recognizing one of the keyboard region coordinate values from the keyboard emulator digital paper and transmitting the recognized coordinate value or the keyboard region coordinate value; and an information communication terminal storing a keyboard region coordinate value range corresponding to the keyboard-dedicated region, the information communication terminal including a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal confirming that the keyboard region coordinate value belongs to the keyboard region coordinate value range, when the keyboard region coordinate value is received from the keyboard emulator/digital pen, and converting the keyboard region coordinate value into a scan code of a keyboard or a keypad by means of the keyboard emulator/digital pen driver.

- [9] In accordance with another aspect of the present invention, there is provided a system for realizing a keyboard emulator by using digital paper and a digital pen, the system including keyboard emulator digital paper including digital paper including a unit cell pattern displaying at least one code of data expressed based on a numeral system having a radix of 2 or larger, the keyboard emulator digital paper including a keyboard-dedicated unit cell pattern displaying at least one keyboard-dedicated code, the keyboard-dedicated code being a code of data expressed in a manner different from the code of data of the digital paper, the keyboard emulator digital paper displaying a keyboard-dedicated pattern including the keyboard-dedicated unit cell pattern, regions of the keyboard emulator digital paper being distinguished by a keyboard-dedicated coordinate value assigned to the keyboard-dedicated unit cell pattern; a keyboard emulator/digital pen including a digital pen for recognizing the code of data from the digital paper and processing the code of data into a coordinate value of the digital paper, the keyboard emulator/digital pen storing the keyboard-dedicated code and the keyboard-dedicated coordinate value, recognizing the keyboard-dedicated code from the keyboard emulator/digital paper, processing the recognized keyboard-dedicated code into the keyboard-dedicated coordinate value, and transmitting scan code conversion request information and the keyboard-dedicated coordinate value, the scan code conversion request information indicating that the keyboard-dedicated coordinate

value is a key input of a keyboard or a keypad; and an information communication terminal having a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal receiving the scan code conversion request information and the keyboard-dedicated coordinate value from the keyboard emulator/digital pen and converting the keyboard-dedicated coordinate value into a scan code of the keyboard or the keypad by means of the keyboard emulator/digital pen driver.

[10] In accordance with another aspect of the present invention, there is provided a system for realizing a keyboard emulator by using digital paper and a digital pen, the system including keyboard emulator digital paper including digital paper including a unit cell pattern displaying at least one code of data expressed based on a numeral system having a radix of 2 or larger, the keyboard emulator digital paper including a keyboard-dedicated unit cell pattern displaying at least one keyboard-dedicated code, the keyboard-dedicated code being a code of data expressed in a manner different from the code of data of the digital paper, the keyboard emulator digital paper displaying a keyboard-dedicated pattern including the keyboard-dedicated unit cell pattern, regions of the keyboard emulator digital paper being distinguished by a keyboard-dedicated coordinate assigned to the keyboard-dedicated unit cell pattern; a keyboard emulator/digital pen for recognizing the code of data from the digital paper or recognizing the keyboard-dedicated code from the keyboard emulator digital paper and transmitting the code of data or the keyboard-dedicated code; and an information communication terminal storing the keyboard-dedicated code and the keyboard-dedicated coordinate value and including a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal processing the keyboard-dedicated code into the keyboard-dedicated coordinate value, when the keyboard-dedicated code is received from the keyboard emulator/digital pen, and converting the keyboard-dedicated coordinate value into a scan code of a keyboard or a keypad by means of the keyboard emulator/digital pen driver.

[11] In accordance with another aspect of the present invention, there is provided a system for realizing a keyboard emulator by using digital paper and a digital pen, the system including keyboard emulator digital paper including digital paper including a unit cell pattern including at least one first cell displaying a code of data expressed based on a numeral system having a radix of 2 or larger and an object display pattern including at least one unit cell pattern, regions of the digital paper being distinguished by a pattern ID assigned to the object display pattern, the keyboard emulator digital paper including the object display pattern assigned a keyboard-dedicated pattern ID, the keyboard-dedicated pattern ID being a pattern ID specific to each key of a keyboard or a keypad;

a keyboard emulator/digital pen including a digital pen for recognizing a coordinate value or the pattern ID from the digital paper, the keyboard emulator/digital pen recognizing the code of data from the keyboard emulator digital paper, processing the code of data into the keyboard-dedicated pattern ID, and transmitting the keyboard-dedicated pattern ID; and an information communication terminal having a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal receiving the keyboard-dedicated pattern ID from the keyboard emulator/digital pen and converting the keyboard-dedicated pattern ID into a scan code of the keyboard or the keypad by means of the keyboard emulator/digital pen driver.

- [12] In accordance with another aspect of the present invention, there is provided a system for realizing a keyboard emulator by using digital paper and a digital pen, the system including digital paper displaying a position display pattern including a number of unit cell patterns, regions of the digital paper being distinguished by a coordinate value or pattern ID assigned to the unit cell patterns; a digital pen for recognizing the coordinate value or the pattern ID from the digital paper; and an information communication terminal having a digital pen driver and a key input API call program, the digital pen driver being a driver of the digital pen, the information communication terminal receiving the coordinate value or the pattern ID from the digital pen by means of the digital pen driver, the information communication terminal converting a coordinate value or a pattern ID within a part or the entire region of the digital paper into a scan code of a keyboard or a keypad by means of the key input API call program when the coordinate value or the pattern ID within a part or the entire region of the digital paper is received while the key input API call program is activated.

Brief Description of the Drawings

- [13] 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:
- [14] FIG. 1 briefly shows an information input system of an information communication terminal using a keyboard according to the prior art;
- [15] FIG. 2 illustrates a part of digital paper displaying a position display pattern on the surface;
- [16] FIGs. 3-6 illustrate an exemplary method for assigning the X coordinate value of a position display pattern;
- [17] FIGs. 7-10 illustrate an exemplary method for assigning the Y coordinate value of a position display pattern;
- [18] FIG. 11 shows another example of a product having a position display pattern on the

surface created by combining the patterns shown in FIGs. 5 and 9;

- [19] FIG. 12 shows exemplary construction of directional flags having no directive feature;
- [20] FIG. 13 shows the number of cases of direction flag cell distribution that can appear on a coordinator window;
- [21] FIG. 14 shows exemplary coding of binary data displayed at first cells;
- [22] FIG. 15 shows X and Y coordinate values corresponding to meaning values of respective line segments shown in FIG. 14;
- [23] FIG. 16 shows codes of binary data displayed at second cells;
- [24] FIG. 17 shows other exemplary codes of binary data displayed at second cells;
- [25] FIG. 18 shows still other exemplary codes of binary data displayed at second cells;
- [26] FIG. 19 briefly shows a system for realizing a keyboard emulator using digital paper and a digital pen according to a first exemplary embodiment of the present invention;
- [27] FIGs. 20 and 21 show examples of keyboard emulator digital paper according to exemplary embodiments of the present invention;
- [28] FIG. 22 shows an exemplary object display pattern according to an exemplary embodiment of the present invention;
- [29] FIG. 23 shows an exemplary coordinate/scan code conversion table according to an exemplary embodiment of the present invention;
- [30] FIG. 24 shows an exemplary pattern ID/scan code conversion table according to an exemplary embodiment of the present invention;
- [31] FIG. 25 shows an exemplary use of a digital pen application; and
- [32] FIG. 26 briefly shows a system for realizing a keyboard emulator using digital paper and a digital pen according to a second exemplary embodiment of the present invention.

Mode for the Invention

- [33] 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 incorporated herein is omitted to avoid making the subject matter of the present invention unclear.
- [34] Prior to describing a system for realizing a keyboard emulator using digital paper and a digital pen, definitions of terminology used herein, as well as digital paper 200, which is a component of the system, will be described in detail.
- [35] The terminology will be described first. Reference numerals of components will be

omitted for clarity.

- [36] A first cell refers to a cell displaying a code of data expressed based on a numeral system having a radix of 2 or larger.
- [37] A second cell refers to a cell displaying a code of data, which is expressed based on a numeral system having a radix of 2 or larger, in a manner distinguished from the first cell.
- [38] A unit cell pattern refers to a pattern consisting of at least a predetermined number of first and second cells, and its coordinate (X and Y coordinate values) or pattern ID is determined by the combination of data corresponding to the codes of data displayed at the first cells.
- [39] An object display pattern refers to a position display pattern used by the digital pen to recognize an object displayed at the digital paper so that the user can identify it with the naked eye. The object display pattern includes at least one unit cell pattern. Unit cell patterns belonging to the same object display pattern have the same pattern ID.
- [40] A position display pattern refers to a pattern including first cells, second cells, unit cell patterns, and object display patterns. The first and second cells correspond to the smallest units of the position display patterns. At least a predetermined number of first and second cells constitute a unit cell pattern, and unit cell patterns having the same pattern ID constitute an object display pattern.
- [41] x refers to data for determining the X coordinate value among data corresponding to codes displayed at first cells.
- [42] y refers to data for determining the Y coordinate value among data corresponding to code displayed at first cells. In this connection, x and y are displayed: (0,0), (0,1), (1,0), or (1,1).
- [43] Digital paper refers to a product having position display patterns displayed thereon. The product includes paper, synthetic resin, etc.
- [44] A digital pen refers to a device for recognizing a position display pattern displayed at the digital paper, i.e. reading the codes of data displayed at the first cells of the digital paper by using an optical system/lens and an image sensor, and combining data corresponding to the codes of data that has been read to recognize the coordinate value or pattern ID of the unit cell pattern. According to an embodiment of the digital paper and digital pen, the user enters a handwriting or picture into the digital paper with the digital pen. Then, the digital pen recognizes the X and Y coordinate values corresponding to the handwriting or picture from the digital paper, and transmits the values to an external device (e.g. personal computer) so that the external device displays the same handwriting or picture entered into the digital paper by the user. According to another embodiment of the digital paper and digital pen, the digital pen recognizes a pattern ID displayed at the digital paper and transmits the pattern ID to an

external device so that the external device provides information corresponding to the pattern ID.

- [45] A keyboard emulator refers to a device or program for emulating the function of a keyboard (or keypad) by using a different type of hardware or software.
- [46] A keyboard-dedicated region refers to a specific one of regions of digital paper designated as a keyboard-dedicated region.
- [47] Keyboard region X and Y coordinates refer to X and Y coordinate values assigned to a unit cell pattern positioned within a keyboard-dedicated region.
- [48] A keyboard-dedicated pattern refers to a pattern displaying codes of data, which are displayed at first cells, in a manner different from the existing one. For example, the codes of data displayed by the keyboard-dedicated pattern are longer or shorter than the existing ones. Alternatively, the codes of data displayed by the keyboard-dedicated pattern have a different position or shape.
- [49] A keyboard-dedicated code refers to a code of data displayed in a manner different from the code of data displayed at a first cell in the existing manner.
- [50] A keyboard-dedicated unit cell pattern consists of at least a predetermined number of first cells displaying keyboard-dedicated codes.
- [51] Keyboard-dedicated X and Y coordinates refer to coordinates of a keyboard-dedicated unit cell pattern determined by a combination of data corresponding to keyboard-dedicated codes.
- [52] A keyboard-dedicated pattern ID refers to a pattern ID specific to each key of a keyboard displayed at keyboard emulator digital paper.
- [53] Keyboard emulator digital paper refers to digital paper used for a keyboard emulator according to an exemplary embodiment of the present invention. The keyboard emulator digital paper has one of a keyboard-dedicated region, a keyboard-dedicated pattern, and a keyboard-dedicated pattern ID printed on a product.
- [54] A keyboard emulator/digital pen refers to a digital pen adapted to recognize one of keyboard region X and Y coordinate values, keyboard-dedicated X and Y coordinate values, and a keyboard-dedicated pattern ID from keyboard emulator digital paper according to an exemplary embodiment of the present invention. The keyboard emulator/digital pen recognizes a coordinate value or pattern ID not only from keyboard emulator digital paper, but also from normal digital paper, and transmits the recognized value to an external device so that the external device displays the user's handwriting or picture or provides information corresponding to the pattern ID.
- [55] The digital paper 200 will now be described in detail.
- [56] FIG. 2 illustrates a part of digital paper displaying position display patterns on its surface.
- [57] Referring to FIG. 2, a position display pattern formed on the surface of digital paper

200 includes first cells 201 displaying encoded binary data, second cells 202 displaying encoded data in a manner distinguished from the first cells 201 or having no data, and a unit cell pattern 210 consisting of at least a predetermined number of first and second cells 201 and 202.

- [58] As shown in FIG. 2, each first cell 201 displays binary data information x and y for assigning the X and Y coordinate values of the unit cell pattern 210, e.g. (0,0), (0,1), (1,0), or (1,1).
- [59] Although it has been assumed in the above description that the data encoded and displayed at respective first and second cells 201 and 202 is binary data, the data is not limited to binary data, and may be based on a numeral system having a different radix depending on the number of code types. For example, besides binary data ($x=0$ or 1 , $y=0$ or 1), the data may be based on a numeral system having a radix of 3 ($x=0, 1$, or 2 , $y=0, 1$, or 2) or a radix of 4 ($x=0, 1, 2$, or 3 , $y=0, 1, 2$, or 3).
- [60] According to the embodiment shown in FIG. 2, a unit cell pattern 210 refers to a set of cells 201 and 202 of $N \times M$ (4×4) size, which can be read as a whole by the sensing means, i.e. digital pen (described later), and recognized separately. The unit cell pattern 210 is also called a window. Such a 4×4 unit cell pattern 210 consists of thirteen first cells 201 and three second cells 202. Although it has been assumed in the description of the present embodiment that the unit cell pattern 210 has the size of 4×4 , the size is not limited to that. Particularly, N and M may be any natural numbers. In addition, although it has also been assumed that N and M are the same, they may be different. In other words, N and M are natural numbers, and $N=M$ or $N \neq M$.
- [61] Referring to FIG. 2, the combination of binary data corresponding to thirteen first cells 201 indicates the coordinate value of the corresponding unit cell pattern (also referred to as a window value). In addition, three second cells 202 are placed in a predetermined position (i.e. lower right corner) within the unit cell pattern 210 so that the second cells 202 are joined by line segments in a predetermined shape (i.e. '└'). Such a set of three second cells 202 placed in predetermined position and shape within the unit cell pattern 210 is referred to as a direction flag 203. The position of the direction flag 203 is determined so that the unit cell pattern 210 is separated and distinguished from other adjacent unit cell patterns, and the shape is determined to identify the direction of the digital paper 200, i.e. the degree of rotation of the digital paper 200, as will be described later in more detail. Although it has been assumed in the description of the present embodiment that the direction flag 203 has the shape of '└', the shape is not limited to that, and the direction flag 203 may have various shapes (e.g. '┐', '┌') as long as it indicates the condition of rotation of the digital paper 200.
- [62] An exemplary method for assigning the X and Y coordinate values of a unit cell pattern will now be described in more detail with reference to FIGs. 3-10.

- [63] Method for assigning X coordinate value of unit cell pattern in position display pattern
- [64] FIG. 3 shows exemplary unit cell patterns 210 in a row in a position display pattern. Although respective cells according to the present invention contain both x and y, i.e. data information regarding both X and Y coordinates of the unit cell patterns 210, as shown in FIG. 2, FIG. 3 separately shows data regarding the X coordinate for convenience of illustration.
- [65] Referring to FIG. 3, the X coordinate value (or binary window value) of the unit cell patterns 210 gradually increases by 1 in the rightward direction:
0000000000000→0000000000001→0000000000010→0000000000011. The X coordinate value (or binary window value) corresponds to a combination of binary data, which corresponds to thirteen first cells 201 within each unit cell pattern 210, in the order from 1 to 13 shown in FIG. 4. Such a gradual increase of the X coordinate value (or binary window value) of the unit cell patterns 210 by one in the 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 NxM cells actually read by the digital pen (described later). However, it is to be noted that, during actual application, images observed by the digital pen may be larger than the coordinate window.
- [66] The unit cell patterns 210 in a row shown in FIG. 3 are repeatedly arranged in the Y direction (vertical direction) so that they span over a plurality of rows, as shown in FIG. 5.
- [67] FIG. 6 shows an embodiment alternative to that shown in FIG. 3. Referring to FIG. 6, the X coordinate value (or binary window value) does not necessarily begin from 0, but an arbitrary value can be the starting value. The digital pen for reading the value is informed of this fact. When the X coordinate value (or binary window data) relative to the starting point is to be obtained, the arbitrary value is subtracted from the currently read X coordinate value (or binary window value). If the maximum value that can be displayed by all X coordinate values (or binary window values) is reached, the next X coordinate value (or binary window value) can be set to be 0.
- [68] Method for assigning Y coordinate value of unit cell pattern in position display pattern
- [69] FIG. 7 shows exemplary unit cell patterns 210 in a column in a position display pattern. Although respective cells contain both x and y, i.e. data information regarding both X and Y coordinates of the unit cell patterns 210, as shown in FIG. 2, FIG. 7 separately shows data regarding the Y coordinate for convenience of illustration.
- [70] Referring to FIG. 7, the Y coordinate value (or binary window value) of the unit cell

patterns 210 gradually increases by 1 in the downward direction:

0000000000000→0000000000001→0000000000010→0000000000011. The Y coordinate value (or binary window value) corresponds to a combination of binary data, which corresponds to thirteen first cells 201 within each unit cell pattern 210, in the order from 1 to 13 shown in FIG. 8. Such a gradual increase of the Y coordinate value (or binary window value) of the unit cell patterns 110 by one in the 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.

- [71] Although FIG. 4 shows the order of reading data contained in respective cells, particularly the X coordinates, while FIG. 8 shows the order of assigning and reading data contained in respective cells, particularly the Y coordinates, the order is not limited to that. For example, it is possible to commonly apply the order shown in FIG. 4 or 8 to both X and Y coordinates. Alternatively, the order shown in FIG. 4 is applied to Y coordinates, and the order shown in FIG. 8 is applied 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 unit cell pattern (window).
- [72] The unit cell patterns 210 in a column shown in FIG. 7 are repeatedly arranged in the horizontal direction so that they span over a plurality of columns, as shown in FIG. 9.
- [73] FIG. 10 shows an embodiment alternative to that shown in FIG. 7. Referring to FIG. 10, the Y coordinate value (or binary window value) does not necessarily begin from 0, but an arbitrary value can be the starting value. The digital pen for reading the value is informed of this fact. When the Y coordinate value (or binary window value) relative to the starting point is to be obtained, the arbitrary value is subtracted from the currently read Y coordinate value (or binary window value). If the maximum value that can be displayed by all Y coordinate values (or binary window values) is reached, the next window value can be set to be 0.
- [74] As mentioned above, respective cells constituting a position display pattern are assigned x (x=0 or 1), i.e. data for assigning the X coordinate value of the unit cell pattern 210, in the manner shown in FIG. 5, and are assigned y (y=0 or 1), i.e. data for assigning the Y coordinate value of the unit cell pattern 210, in the manner shown in FIG. 9. Then, the X and Y coordinate values (shown in FIGs. 5 and 9, respectively) in the same cell position are combined to obtain a position display pattern according to the present invention, as shown in FIG. 11. The X and Y coordinate values are assigned with regard to each unit cell pattern 210.
- [75] A comparison between the position display patterns shown in FIGs. 2 and 11 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 cor-

responding to first cells 201 within the unit cell pattern 210, as has been described with reference to FIGs. 2 and 8. Particularly, the position display pattern shown in FIG. 2 corresponds to an example of applying the order of assigning/combining binary data shown in FIG. 8 to both X and Y coordinates. The position display pattern shown in FIG. 11 corresponds to an example of applying the order of assigning/combining binary data shown in FIG. 4 to X coordinates and applying the order of assigning/combining binary data shown in FIG. 8 to Y coordinates. However, in either case of the position display patterns shown in FIG. 2 and 11, the coordinate value of corresponding unit cell patterns is the same.

- [76] The direction flag 203 will be described in more detail with reference to FIG. 2.
- [77] Second cells 202 constituting a direction flag 203 must be arranged so that the direction flag itself has a directive feature. This requires at least three second cells 202. If a smaller number of second cells constitute a direction flag, it has at least two directive features no matter how the second cells 202 are arranged. However, if the direction flag 203 is not to be used for rotation sensing, but just for error correction, two or more cells may constitute the direction flag 203. Furthermore, if the direction flag 203 is simply used to distinguish between adjacent unit cell patterns, the direction flag may consist of only one second cell 202.
- [78] When the direction flag 203 is not used for error correction, but solely for rotation sensing, the second cells 202 contain no information. Alternatively, the second cells 202 contain information encoded and displayed in a manner distinguished from the first cells 201 to make it known that they constitute a direction flag 203.
- [79] When the direction flag 203 is solely used for rotation sensing, it is enough to use three second cells 202 containing no information, and the three cells are preferably joined by line segments in the shape of '┐'.
- [80] Some arrays of three cells have no directive feature because the three cells are arranged along a straight line (e.g. '-', '／', '\') as shown in FIG. 12, or because they have no center point, and are preferably excluded.
- [81] Assuming that '┐'-shaped direction flags 203 are used, there are three possible types of distribution of second cells 202, as shown in FIG. 13a, FIG. 13b, and FIG. 13c, which can be considered on a coordinate window to find the angle or rotation (90°, 180°, 270°) of digital paper having a position display pattern printed thereon. Particularly, all cells are positioned next to one another on a coordinate window in the case of FIG. 13a, cells are divided into two groups in the case of FIG. 13b, and cells are divided into three groups in the case of FIG. 13c.
- [82] In any case of FIG. 13a, FIG. 13b, and FIG. 13c, 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 is

restored in this manner.

- [83] 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. 13a has not rotated; restoration of the direction flag shown in FIG. 13b gives the shape of '└' and indicates clockwise 90° rotation; and restoration of the direction flag shown in FIG. 13c gives the shape of '┐' and indicates 180° rotation. Such characteristics are used to obtain the angle of rotation of the digital paper 200, and make it possible to rotate a matrix of cells on the coordinate window accordingly.
- [84] The correction of errors of a position display pattern will now be described.
- [85] Error correction requires that 2-bit binary data be encoded and displayed at second cells 202 of the above-mentioned direction window 203 for distinguishing a window in a manner different from that of first cells 201. The 2-bit values become the error correcting codes for the X and Y coordinate values of a unit cell pattern 210, respectively. The error correcting code for the X coordinate value of a unit cell pattern 210 functions independent of that for the Y coordinate value of the unit cell pattern 210, but in the same manner. Therefore, the error correcting code for the X coordinate of the unit cell pattern 210 will solely be described for clarity.
- [86] A 4x4 window contains 13-bit information regarding the X coordinate value of a unit cell pattern 210. However, 2-bit error correction requires at least 4 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 correcting codes. To this end, the number of second cells 202 constituting the direction flag must be increased by 1 (i.e. a total of 4). Then, 11 of 12 first cells 201 are subjected to error correction, and the remaining one cell is subjected to error processing by the upper layer.
- [87] A method for correcting bits other than the upper one bit will now be described.
- [88] Second cells 202 constituting a direction flag 203 are reconstructed so that they amount to 4. Respective second cells 202 are encoded by using a type of representation different from that of first cells 201 so that the second cells 202 can contain 2-bit information. The method for calculating the X and Y coordinate values of a unit cell pattern 210 is the same as mentioned above even if the second cells 202 amount to 4. The only difference is that the number of first cells 201 within the window is reduced by one. Then, RS coding (one of error correcting codes) is used to calculate (encode) error correcting codes with regard to the entire information (or a part of it) existing in the data cells, and the error correcting codes are encoded and displayed at the direction

flag 203. If the window is not read accurately, but obliquely, the error correcting 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.

- [89] A method for limitedly correcting the errors of lower bits only will now be described.
- [90] 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 solely conducted with regard to bits of lower positional numbers, which undergo frequent change, the number of second cells 202 constituting a direction flag 203 can be reduced. As a result, a larger number of different unit cell patterns (windows) can be realized. As mentioned above, the number of cells constituting a direction flag 203 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.
- [91] 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 a position display pattern, the method is not limited to that type.
- [92] Binary data codes displayed at the first and second cells 201 and 202 will now be described.
- [93] FIG. 14 shows exemplary binary data codes displayed at the first cells 201. Particularly, assuming that virtual X and Y axes intersect with each other at the center point of each cell, FIG. 14a shows a first line segment lying on the X axis with the intersection point at its center, FIG. 14b shows a second line segment lying on the Y axis with the intersection point at its center, FIG. 14c shows a third line segment lying in the first and third quadrants with the intersection point at its center, and FIG. 14d 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. Those skilled in the art can understand that the scheme shown in FIG. 14 is only an example, and the binary data codes displayed at the first cells 201 may be based on a different scheme.
- [94] FIG. 15 shows a table enumerating data for assigning the X and Y coordinate values of a unit cell pattern 210 corresponding to the meaning value of respective line segments shown in FIG. 14. Particularly, the first line segment shown in FIG. 14a has a meaning value of 0, and the corresponding x and y are (1,1). The second line segment shown in FIG. 14b has a meaning value of 1, and the corresponding x and y

are (0,1). The third line segment shown in FIG. 14c has a meaning value of 2, and the corresponding x and y are (1,0). The fourth line segment shown in FIG. 14d has a meaning value of 3, and the corresponding x and y are (0,0). Those skilled in the art can understand that the matching between the meaning values and x and y shown in FIG. 14 is only an example, and can be varied as desired. In this case, x refers to data entered into the first cells 201 to assign the X coordinate value to the unit cell pattern 210, and y refers to data entered into the first cells 201 to assign the Y coordinate value to the unit cell pattern 210.

- [95] FIG. 16 shows codes of binary data displayed at the second cells 202. 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 in the first and second quadrants in parallel with the X axis, FIG. 16b shows a second line segment lying in the third and fourth quadrants in parallel with the X axis, FIG. 16c shows a third line segment lying in the second and third quadrants in parallel with the Y axis, and FIG. 16d 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.
- [96] Referring to FIG. 15, the first line segment shown in FIG. 16a has a meaning value of 0, and the corresponding data is (1,1). The second line segment shown in FIG. 16b has a meaning value of 1, and the corresponding data is (0,1). The third line segment shown in FIG. 16c has a meaning value of 2, and the corresponding data is (1,0). The fourth line segment shown in FIG. 16d has a meaning value of 3, and the corresponding data is (0,0).
- [97] As another example of binary data codes displayed at the second cells 202, line segments may be displayed in the same manner as the first to fourth line segments of first cells shown in FIGs. 14a to 14d, except that they have different lengths to be distinguished from the line segments of the first cells.
- [98] FIG. 17 shows another example of binary data codes displayed at the second cells 202. Particularly, assuming that virtual X and Y axes intersect with each other at the center point of each cell, FIG. 17a shows a first line segment extending from the intersection point to a point in the first quadrant, FIG. 17b shows a second line segment extending from the intersection point to a point in the second quadrant, FIG. 17c shows a third line segment extending from the intersection point to a point in the third quadrant, and FIG. 17d 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 corresponds to data expressed as (0,0), (0,1), (1,0), and (1,1).
- [99] FIG. 18 shows another example of binary data codes displayed at the second cells 202. 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 on the positive X and Y axes with the intersection point at its center, FIG. 18b 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. 18c shows a third line segment lying on the negative X and Y axes with the intersection point at its center, and FIG. 18d 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 corresponds to data expressed as (0,0), (0,1), (1,0), and (1,1).

- [100] Various types of line segments have been described as means for encoding binary data displayed at the first or second cells 202. Respective line segments, 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.
- [101] Furthermore, although it has been assumed in the above description that binary data is encoded and displayed at respective cells, 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.
- [102] Having described the digital paper 200 in detail, a system for realizing a keyboard emulator using digital paper and a digital pen according to a first exemplary embodiment of the present invention will now be described.
- [103] For clear distinction between keyboard emulator digital paper 310 and digital paper 200 in the following description, the digital paper 200 will hereinafter be referred to as normal digital paper 200.
- [104] FIG. 19 briefly shows a system for realizing a keyboard emulator using digital paper and a digital pen according to a first exemplary embodiment of the present invention. As used herein, an emulator refers to a device or program for emulating the function of hardware or software by using a different kind of hardware or software.
- [105] The system for realizing a keyboard emulator using digital paper and a digital pen according to a first exemplary embodiment of the present invention includes keyboard emulator digital paper 310, a keyboard emulator/digital pen 320, and a first information communication terminal 330. Although a personal computer is shown in FIG. 19 as the first information communication terminal 330, the first information communication terminal 330 is not limited to the personal computer, and may be a PDA, mobile communication terminal, etc. In this case, the keyboard emulator/digital pen driver 332 is programmed and installed according to the type of the first in-

formation communication terminal 330 (e.g. personal computer, PDA, mobile communication terminal, etc.).

- [106] The system for realizing a keyboard emulator using digital paper and a digital pen according to a first exemplary embodiment of the present invention shown in FIG. 19 is compatible with a keyboard 110. In other words, the user can input a scan code with either the keyboard 110 or the keyboard emulator according to an exemplary embodiment of the present invention.
- [107] The keyboard emulator digital paper 310 according to the present invention has codes, which are expressed based on a numeral system having a radix of 2 or larger, displayed at the first cells 201, as has been described with reference to FIGs. 2-18. The X and Y coordinate values or pattern ID of a unit cell pattern 210 is determined based on the codes. In addition, the keyboard emulator digital paper 310 according to the present invention displays keys of the keyboard 110, as shown in FIGs. 20 and 21, so that the user can identify the keys of the keyboard 110 with the naked eye. It will be assumed in the following description that data encoded and displayed at the first cells 201 is binary data, as has been described with reference to FIGs. 2-18.
- [108] There are a number of schemes for displaying an array of keys of the keyboard 110 on the keyboard emulator digital paper 310 according to an exemplary embodiment of the present invention, as shown in FIG. 20. According to the first scheme, a part or the entire region of normal digital paper 200, which is distinguished by the X and Y coordinates of a unit cell pattern 210 (i.e. position display pattern described with reference to FIGs. 2-18), is designated as a keyboard-dedicated region. In other words, some or all of the position display patterns of the normal digital paper 200 are assigned a number of keyboard region X and Y coordinate values. According to the second scheme, the keyboard emulator digital paper 310 displays a keyboard-dedicated pattern different from the position display pattern described with reference to FIGs. 2-18. Particularly, the keyboard-dedicated pattern displays codes of binary data at first cells 201 in a manner different from that shown in FIG. 14 (e.g. the length of codes is different from that shown in FIG. 14, or the position of codes relative to virtual X and Y axes is made different; hereinafter, codes of binary data displayed at first cells in a manner different from that shown in FIG. 14 are referred to as keyboard-dedicated codes). Those skilled in the art can understand that, in the case of the second scheme, the keyboard-dedicated pattern includes a keyboard-dedicated unit cell pattern including at least one first cell displaying a keyboard-dedicated code, and that the region of the keyboard emulator digital paper 310 is distinguished based on the keyboard-dedicated X and Y coordinates assigned to the keyboard-dedicated unit cell pattern.
- [109] When the keyboard emulator digital paper 310 displays keyboard keys regardless of the conventional key arrangement, as shown in FIG. 21, the keyboard emulator digital

paper 310 is assigned a keyboard-dedicated pattern ID, i.e. a pattern ID specific to each keyboard key (third scheme). As used herein, the pattern ID refers to a unique ID assigned to an object display pattern 340 consisting of at least one unit cell pattern 210. The pattern ID is indicated by a combination of data corresponding to a code of binary data of at least one first cell 201 included in a unit cell pattern 210. Unit cell patterns 210 belonging to the same object display pattern 340 have the same pattern ID. In addition, the object display pattern 340 refers to a position display pattern needed by the digital pen 320 to recognize an object displayed on the keyboard emulator digital paper 310 so that the user can identify it with the naked eye.

- [110] The case of "ESC key" among keyboard keys will now be described. Referring to FIG. 22, the object display pattern 340 corresponding to the "ESC key" consists of a number of unit cell patterns 210 positioned within the region of the object "ESC key". The object display pattern 340 is assigned a pattern ID particular to the object, i.e. a keyboard-dedicated pattern ID corresponding to the "ESC key", which is a combination of data corresponding to codes of binary data displayed at the first cells 201 of the unit cell pattern 210. Unit cell patterns 210 constituting the object display pattern 340 have the same keyboard-dedicated pattern ID. For example, if the object display pattern 340 corresponding to the "ESC key" is assigned keyboard-dedicated pattern ID "003", unit cell patterns 210 constituting the object display pattern 340 have the same keyboard-dedicated pattern ID "003". It is obvious from the above description that, although not shown in FIG. 22, each unit cell pattern 210 consists of a number of first and second cells 201 and 202.
- [111] In summary, the keyboard emulator digital paper 310 according to the present invention refers to digital paper manufactured according to one of the above-mentioned first to third schemes and used for the system for realizing a keyboard emulator according to an exemplary embodiment of the present invention.
- [112] The normal digital paper 200 described with reference to FIGs. 2-18 includes a normal region, which includes a position display pattern assigned no keyboard region coordinate value (i.e. it is not based on one of the first to third schemes). The normal digital paper 200 has codes of binary data, which are different from the keyboard-dedicated codes, displayed at the first cells 201 (i.e. displayed in the manner shown in FIG. 14). In addition, the normal digital paper 200 has a normal pattern ID (not a keyboard-dedicated pattern ID) assigned to the object display pattern. The position display pattern in the normal region is assigned normal coordinate values so that, when a handwriting or picture is entered into the digital paper by using the keyboard emulator/digital pen, the first information communication terminal can display the handwriting or picture by means of a digital pen application that uses the normal coordinate values.

- [113] This enables the user to enter a handwriting or picture into the normal digital paper 200 with the keyboard emulator/digital pen 320 or select an object display pattern, which is displayed on the normal digital paper 200, with the keyboard emulator/digital pen 320, as shown in FIG. 25.
- [114] Although the keyboard emulator digital paper 310 and the normal digital paper 200 are shown in FIG. 19 separate from each other, they may be printed on the same product during actual application of the present invention.
- [115] Particularly, the keyboard emulator digital paper 310 and the normal digital paper 200 can be printed on the same product in one of the following methods: according to the first method, a position display pattern included in a partial region of a piece of digital paper is assigned a keyboard region coordinate value, and the remaining region (i.e. normal region) is assigned a normal coordinate value; according to the second method, a partial region of a piece of digital paper includes a keyboard-dedicated pattern displaying a keyboard-dedicated code, and the remaining region includes an existing position display pattern (i.e. normal position display pattern); and, according to the third method, a partial region of a piece of digital paper displays a keyboard-dedicated pattern ID, and the remaining region displays a normal pattern ID.
- [116] The keyboard emulator/digital pen 320 according to the present invention is adapted to recognize at least one piece of information selected from keyboard region X and Y coordinate values, keyboard-dedicated X and Y coordinate values, and a keyboard-dedicated pattern ID from a unit cell pattern 210 displayed at the keyboard emulator digital paper 310, and transmits the recognized information to the first information communication terminal 330. The keyboard emulator/digital pen 320 also recognizes a unit cell pattern 210 displayed at the normal digital paper 200 and transmits the recognized information to the first information communication terminal 330. Particularly, the keyboard emulator/digital pen 320 recognizes at least one piece of information selected from keyboard region X and Y coordinate values, keyboard-dedicated X and Y coordinate values, and a keyboard-dedicated pattern ID from the keyboard emulator digital paper 310 and transmits the recognized information to the first information communication terminal 330 so that the first information communication terminal 330 transmits a scan code, which corresponds to the information recognized by the keyboard emulator/digital pen 320, to an application currently activated by the first information communication terminal 330. In addition, the keyboard emulator/digital pen 320 recognizes normal X and Y coordinate values from the normal digital pen 200 and transmits the values to the first information communication terminal 330 so that the first information communication terminal 330 displays a handwriting or picture, which has been entered into the digital paper 200 by the user with the keyboard emulator/digital pen 320.

- [117] Although not shown in FIG. 19, the keyboard emulator/digital pen 320 includes an optical system/lens for optically inputting a position display pattern including an object display pattern 340 and a unit cell pattern 210; an image sensor for recognizing the image of the inputted position display pattern; a microprocessor for processing information inputted from the image sensor; an internal memory for storing predetermined information under the control of the microprocessor; and a USB interface for communicating with an external device under the control of the microprocessor.
- [118] The keyboard emulator/digital pen 320 according to the present invention stores a keyboard region X and Y coordinate value range, which corresponds to the keyboard-dedicated region, or a keyboard-dedicated code and dedicated code data, i.e. data (0 or 1, in the case of binary data) corresponding the keyboard-dedicated code, in the internal memory so that data regarding a unit cell pattern 210 recognized from the keyboard emulator digital paper 310 is processed into keyboard region X and Y coordinate values or keyboard-dedicated X and Y coordinates.
- [119] It can be said that, if the keyboard emulator/digital pen 320 stores a keyboard region X and Y coordinate value range, the keyboard emulator digital paper 310 has designated a part or the entire region of normal digital paper 200 as a keyboard-dedicated region, and, if the keyboard emulator/digital pen 320 stores a keyboard-dedicated code and dedicated code data, the keyboard emulator digital paper 310 displays a keyboard-dedicated pattern, which is different from the position display pattern described with reference to FIGs. 2-18, i.e. codes of binary data displayed in a manner different from that of the codes of binary data displayed at the first cells 201 shown in FIG. 14 (keyboard-dedicated codes), so that a number of keyboard-dedicated X and Y coordinate values resulting from the keyboard-dedicated pattern are assigned to the keyboard emulator digital paper 310.
- [120] This will be described in more detail.
- [121] The keyboard emulator/digital pen 310 approaches a specific one of the keyboard keys displayed at the keyboard emulator digital paper 310 shown in FIG. 20, and recognizes the position display pattern of the keyboard emulator digital paper 310, i.e. codes of the first and second cells 201 and 202 of the keyboard emulator digital paper 310, by means of the optical system/lens and the image sensor. Codes resulting from recognition of the first cells 201 (i.e. recognition codes) are processed into X and Y coordinates by means of the microprocessor. The codes in this connection refer to binary data codes.
- [122] When the keyboard emulator/digital pen 320 has a keyboard region X and Y coordinate value range stored in the internal memory, the microprocessor of the keyboard emulator/digital pen 320 compares X and Y coordinate values, which have been recognized from the keyboard emulator digital paper 310 manufactured according

to the first scheme, with the keyboard region X and Y coordinate value range stored in the internal memory. If the X and Y coordinate values lie within the keyboard region X and Y coordinate value range, (i.e. if the X and Y coordinate values are keyboard region X and Y coordinates), the microprocessor creates scan code conversion request information and transmits the keyboard region X and Y coordinate values and the scan code conversion request information to the first information communication terminal 330 (described later) via the USB interface. As used herein, the scan code conversion request information refers to information notifying that the keyboard region X and Y coordinate values or keyboard-dedicated X and Y coordinate values are keyboard key inputs.

- [123] When the keyboard emulator/digital pen 320 has a keyboard-dedicated code and dedicated code information stored in the internal memory, the keyboard emulator/digital pen 320 compares a recognition code, i.e. a code that has been recognized from the keyboard emulator digital paper 310 or the normal digital paper 200 by means of the optical system/lens and image sensor, with the keyboard-dedicated code stored in the internal memory. If the recognition code coincides with the keyboard-dedicated code, the keyboard emulator/digital pen 320 processes the recognition code into keyboard-dedicated X and Y coordinates based on a combination of dedicated code data corresponding to the recognition code, creates scan code conversion request information, and transmits the keyboard-dedicated X and Y coordinate values and the scan code conversion request information to the first information communication terminal 330 (described later) via the USB interface. In this case, the keyboard emulator digital paper 310 is manufactured according to the second scheme.
- [124] If it has been confirmed as a result of comparison between the X and Y coordinate values and the keyboard region X and Y coordinate value range by the keyboard emulator/digital pen 320 that the X and Y coordinate values lie out of the keyboard region X and Y coordinate value range, i.e. if the keyboard emulator/digital pen 320 has recognized X and Y coordinate values included in a normal region (i.e. normal X and Y coordinate values) from the normal digital paper 200, the keyboard emulator/digital pen 320 does not create scan code conversion request information, but solely transmits normal X and Y coordinate values to the first information communication terminal 330 (described later).
- [125] If it has been confirmed as a result of comparison between the recognition code and the keyboard-dedicated code by the keyboard emulator/digital pen 320 that the recognition code does not coincide with the keyboard-dedicated code, i.e. if the keyboard emulator/digital pen 320 has recognized a code from normal digital paper 200, the keyboard emulator/digital pen 320 does not create scan code conversion request information, but processes the recognition code into X and Y coordinate values

and transmits them to the first information communication terminal 330.

- [126] As such, the keyboard emulator/digital pen 320 according to an exemplary embodiment of the present invention can recognize information from both keyboard emulator digital paper 310 and normal digital paper 200.
- [127] Meanwhile, the keyboard emulator/digital pen 320 according to the present invention recognizes a keyboard-dedicated pattern ID indicated by each unit cell pattern 210 constituting an object display pattern 340 and transmits the ID to the first information communication terminal 330 (described later). For example, if the keyboard emulator/digital pen 320 approaches "ESC key" among the keys of the keyboard shown in FIG. 21, the keyboard emulator/digital pen 320 recognizes the code of binary data displayed at one of unit cell patterns 210 constituting the object display pattern 340 corresponding to the "ESC key" and transmits the code to the first information communication terminal 330.
- [128] The first information communication terminal 330 according to the present invention refers to an information communication terminal having a keyboard emulator/digital pen driver 322 installed therein according to an exemplary embodiment of the present invention. Particularly, the first information communication terminal 330 includes a keyboard emulator/digital pen driver 332, a BIOS 124, and a buffer 126. When the first information communication terminal 330 receives scan code conversion request information and keyboard region X and Y coordinate values, or scan code conversion request information and keyboard-dedicated X and Y coordinate values from the keyboard emulator/digital pen 320, the first information communication terminal 330 converts the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values into a scan code corresponding to a specific key by means of the keyboard emulator/digital pen driver 332, and transmits the scan code to the BIOS 124 or the buffer 126. Then, the first information communication terminal 330 transmits the scan code to the currently activated application so that the application conducts a function corresponding to the specific key input.
- [129] The keyboard emulator/digital pen driver 332 installed in the first information communication terminal 330 converts the keyboard region X and Y coordinate values or keyboard-dedicated X and Y coordinate values, which have been received from the keyboard emulator/digital pen 320, into a scan code and transmits it to the BIOS 124 or the buffer 126. To this end, the keyboard emulator/digital pen driver 332 includes a coordinate/scan code conversion table for converting keyboard region X and Y coordinate values or keyboard-dedicated X and Y coordinate values into a scan code, as shown in FIG. 23.
- [130] The keyboard emulator/digital pen driver 332 compares the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values, which have

been received from the keyboard emulator/digital pen 320, with the coordinate value/scan code conversion table. If the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values correspond to a specific X and Y coordinate value range enumerated in the coordinate/scan code conversion table, the keyboard emulator/digital pen driver 332 converts the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values into a scan code corresponding to the specific X and Y coordinate value range.

- [131] For example, if the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values are (160,24), the keyboard emulator/digital pen 320 compares them with the coordinate/scan code conversion table and, if it is confirmed that the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values correspond to X and Y coordinate value range (151-170, 21-40) enumerated in the coordinate/scan code conversion table, converts the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values into scan code "2", which corresponds to the X and Y coordinate value range (151-170 21-40) enumerated in the coordinate/scan code conversion table.
- [132] Upon receiving a keyboard-dedicated pattern ID from the keyboard emulator/digital pen 320, the first information communication terminal 330 converts the keyboard-dedicated pattern ID into a scan code corresponding to a specific key by means of the keyboard emulator/digital pen driver 332, and transmits the scan code to the BIOS 124 or the buffer 126. Then, the first information communication terminal 330 transmits the scan code to the currently activated application so that the application conducts a function corresponding to the specific key input.
- [133] The keyboard emulator/digital pen driver 332 converts the keyboard-dedicated pattern ID, which has been received from the keyboard emulator/digital pen 320, into a scan code and transmits it to the BIOS 124 or the buffer 126. To this end, the keyboard emulator/digital pen driver 332 includes a pattern ID/scan code conversion table for converting a keyboard-dedicated pattern ID into a scan code, as shown in FIG. 24.
- [134] The keyboard emulator/digital pen driver 332 compares a keyboard-dedicated pattern ID, which has been received from the keyboard emulator/digital pen 320, with the pattern ID/scan code conversion table and, if the keyboard-dedicated pattern ID coincides with a specific pattern ID enumerated in the pattern ID/scan code conversion table, converts the pattern ID into a scan code corresponding to the specific pattern ID.
- [135] For example, if the keyboard-dedicated pattern ID is "002", the keyboard emulator/digital pen 320 compares the ID with the pattern ID/scan code conversion table and, if the keyboard-dedicated pattern ID coincides with specific pattern ID "002" enumerated in the pattern ID/scan code conversion table, converts the keyboard-dedicated pattern ID into scan code "002", which corresponds to the specific pattern ID enumerated in

the pattern ID/scan code conversion table.

- [136] If the first information communication terminal 330 has received no scan code conversion request information but only normal X and Y coordinate values from the keyboard emulator/digital pen 320, or if the first information communication terminal 330 has received a normal pattern ID that is not enumerated in the pattern ID/scan code conversion table, the keyboard emulator/digital pen driver 332 does not convert the X and Y coordinate values or the normal pattern ID into a scan code. If the application currently activated by the first information communication terminal 330 is a digital pen application, which is used by the information communication terminal to display a handwriting or picture that has been entered into the digital paper by the user with the digital pen as shown in FIG. 25, or which is used by the information communication terminal to display information regarding a pattern ID recognized from the digital paper by the digital pen, the keyboard emulator/digital pen driver 332 transmits the normal X and Y coordinate values or the pattern ID to the digital pen application so that the first information communication terminal 330 displays the handwriting or picture, which is entered into the normal digital paper 200 by the user, in real time or provides information regarding the normal pattern ID.
- [137] Although it has been assumed for convenience of description of the present invention that the keyboard emulator/digital pen 320 stores a keyboard region X and Y coordinate value range, which corresponds to the keyboard-dedicated region, or a keyboard-dedicated code and data (0 or 1 in the case of binary data) corresponding to the keyboard-dedicated code, i.e. dedicated code data, in the internal memory, and processes data of a unit cell pattern 210 recognized from the keyboard emulator/digital paper 310 into keyboard region X and Y coordinate values or keyboard-dedicated X and Y coordinates, the first information communication terminal 330 may store a keyboard region X and Y coordinate value range or a keyboard-dedicated code and dedicated code data during actual application of the present invention.
- [138] When the first information communication terminal 330 stores a keyboard region X and Y coordinate value range, the first information communication terminal 330 receives X and Y coordinate values from the keyboard emulator/digital pen 320 and determines if the X and Y coordinate values belong to the keyboard region X and Y coordinate value range. If so, the X and Y coordinate values can be converted into a scan code. In this case, the keyboard emulator/digital pen 320 stores no keyboard region X and Y coordinate value range in the internal memory, but recognizes keyboard region X and Y coordinate values from the keyboard emulator digital paper 310 or recognizes normal X and Y coordinate values from the normal digital paper 200, and transmits the recognized values to the first information communication terminal 330.

- [139] If the first information communication terminal 330 has a keyboard-dedicated code and dedicated code information stored therein, the first information communication terminal 330 receives a recognition code from the keyboard emulator/digital pen 320 and compares the recognition code with the keyboard-dedicated code. If the recognition code coincides with the keyboard-dedicated code, the recognition code is processed into keyboard-dedicated X and Y coordinates by means of a combination of dedicated code data corresponding to the recognition code, and the keyboard-dedicated X and Y coordinates are converted into a scan code. In this case, the keyboard emulator/digital pen 320 does not store a keyboard-dedicated code and dedicated code information in the internal memory, but solely transmits the recognition code, which has been recognized from the keyboard emulator digital paper 310 or the normal digital paper 200, to the first information communication terminal 330.
- [140] If it has been confirmed as a result of the comparison between the X and Y coordinate values and the keyboard region X and Y coordinate value range or between the recognition code and the keyboard-dedicated code by the first information communication terminal 330 that the X and Y coordinate values do not lie within the keyboard region X and Y coordinate value range or that the recognition code does not coincide with the keyboard-dedicated code, i.e. if the first information communication terminal 330 has received information recognized from the normal digital paper 200 by the digital emulator/digital pen 320, the first information communication terminal 320 transmits the normal X and Y coordinate values received from the keyboard emulator/digital pen 320 to the digital pen application. Alternatively, the first information communication terminal 320 processes the recognition code received from the keyboard emulator/digital pen 320 into normal X and Y coordinate values and transmits them to the digital pen application.
- [141] FIG. 23 shows an exemplary coordinate/scan code conversion table according to an exemplary embodiment of the present invention.
- [142] Particularly, FIG. 23 shows a table for converting keyboard region X and Y coordinate values or keyboard-dedicated X and Y coordinate values into a scan code. If the keyboard emulator/digital pen driver 332 installed in the first information communication terminal 330 receives scan code conversion request information and keyboard region X and Y coordinate values or scan code conversion request information and keyboard-dedicated X and Y coordinate values from the keyboard emulator/digital pen 320, the digital pen driver 332 compares the coordinate value/scan code conversion table with the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values.
- [143] If the X coordinate value of the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values has a range of 101-120 while the Y

coordinate value has a range of 21-40, the keyboard emulator/digital pen driver 332 transmits the corresponding scan code "1" to the BIOS 124 or buffer 126. If the X coordinate value of the keyboard region X and Y coordinate values or the keyboard-dedicated X and Y coordinate values has a range of 126-145 while the Y coordinate value has a range of 21-40, the keyboard emulator/digital pen driver 332 transmits the corresponding scan code "2" to the BIOS 124 or buffer 126.

[144] FIG. 24 shows an exemplary pattern ID/scan code conversion table according to an exemplary embodiment of the present invention.

[145] Particularly, FIG. 24 shows a table for converting a keyboard-dedicated pattern ID into a scan code. If the keyboard emulator/digital pen 320 has recognized keyboard-dedicated pattern ID "000" from the keyboard emulator digital paper 310, the keyboard emulator/digital pen driver 332 transmits the corresponding scan code "0" to the BIOS 124 or buffer 126. If the keyboard-dedicated pattern ID is "001", the keyboard emulator/digital pen driver 332 transmits the corresponding scan code "1" to the BIOS 124 or buffer 126.

[146] FIG. 26 briefly shows a system for realizing a keyboard emulator using digital paper and a digital pen according to a second exemplary embodiment of the present invention.

[147] The system for realizing a keyboard emulator using digital paper and a digital pen according to a second exemplary embodiment of the present invention includes keyboard display digital paper 610, a normal digital pen 620, a second information communication terminal 630, a digital pen driver 632, and a key input API (Application Program Interface) call program 634.

[148] The keyboard display digital paper 610 refers to normal digital paper 200 having keyboard keys displayed in a specific region as shown in FIG. 20, or digital paper having keyboard keys displayed regardless of the conventional key arrangement as shown in FIG. 21, with respective keys assigned different pattern IDs.

[149] When the keyboard input API call program 634 (described later) is activated by the second information communication terminal 630, a pattern ID or X and Y coordinate values included in the region of the keyboard display digital paper 610 are converted into a scan code by the keyboard input API call program 634. When the keyboard input API call program 634 is not activated, the pattern ID or X and Y coordinate values included in the region of the keyboard display digital paper 610 are not converted into a scan code. The keyboard display digital paper 610 displays keyboard keys in a part or the entire region of normal digital paper 200 so that the user can identify the keys with the naked eye. This enables the user to easily input a scan code regarding a pattern ID or X and Y coordinate values in a specific region while the keyboard input API call program is activated.

- [150] Meanwhile, even in the case of normal digital paper 200 having no keyboard keys displayed in a part or the entire region, X and Y coordinate values included in a part or the entire region of the normal digital paper 200 or a pattern ID displayed at the digital paper 200 can be converted into a scan code by the keyboard input API call program while the keyboard input API call program remains activated by the second information communication terminal 630. However, the user cannot identify keyboard keys from the normal digital paper 200 with the naked eye. This means that the normal digital pen cannot accurately recognize the X and Y coordinate values or pattern ID corresponding to the scan code that the user wants to input.
- [151] The normal digital pen 620 is solely adapted to recognize X and Y coordinate values or a pattern ID from the normal digital paper 200 or the keyboard display digital paper 610 and transmit the result of recognition to the second information communication terminal 630.
- [152] Particularly, the normal digital pen 620 is not adapted to create scan code conversion request information for converting X and Y coordinate values or a pattern ID into a scan code, as in the case of the keyboard emulator/digital pen 320, but just recognizes X and Y coordinate values or a pattern ID from the normal digital paper 200 or the keyboard display digital paper 610 and transmits the result of recognition to the second information communication terminal 630. This means that the normal digital pen 620 needs not store a keyboard region X and Y coordinate value range or a keyboard-dedicated code and dedicated code data in the internal memory.
- [153] The second information communication terminal 630 refers to a PC, a PDA, or a mobile communication terminal having a digital pen driver 632 and a key input API call program 634 installed therein.
- [154] The digital pen driver 632 installed in the second information terminal 630 refers to a driver program for the normal digital pen 620. When the key input API call program 634 is not activated by the second information communication terminal 630, the second information communication terminal 630 receives X and Y coordinate values or a pattern ID from the normal digital pen 620 via the digital pen driver 632, and transmits the received ones to the digital pen application.
- [155] For example, when the second information communication terminal 630 receives a pattern ID or X and Y coordinate values in a part or the entire region of keyboard display digital paper 620, which has keyboard keys displayed in a part or the entire region of digital paper 200, or a pattern ID or X and Y coordinate values in a part or the entire region of normal digital paper 200, which has no keyboard keys displayed in part or entire region, the second information communication terminal 630 does not conduct a scan code conversion process with regard to the X and Y coordinate values or pattern ID, but displays a point marked on the keyboard display digital paper 620 or

normal digital paper 200 by the user with the normal digital pen 620 by means of the display unit 130, or displays information corresponding to the pattern ID, when the key input API call program 634 has not been activated by the second information communication terminal 630.

- [156] When the key input API call program 634 has been activated by the second information communication terminal 630, the second information communication terminal 630 receives X and Y coordinate values or a pattern ID from the normal digital pen 620 via the digital pen driver 632, and transmits the received ones to the key input API call program 634. Particularly, when the key input API call program 634 has been executed by the second information communication terminal 630, the digital pen driver 632 transmits the X and Y coordinate values or the specific pattern ID received from the normal digital paper 620 to the key input API call program 634, not to the digital pen application. Then, the key input API call program 634 conducts a process for converting the transmitted ones into a keyboard scan code.
- [157] The key input API call program 634 according to the present invention includes a coordinate/scan code conversion table shown in FIG. 23, or a pattern ID/scan code conversion table shown in FIG. 24.
- [158] When the key input API call program 634 includes the coordinate/scan code conversion table, the key input API call program 634 receives X and Y coordinate values from the digital pen driver 632 when activated by the second information communication terminal 630. Then, the key input API call program 634 compares the X and Y coordinate values with the coordinate/scan code conversion table and, if the X and Y coordinate values correspond to a specific keyboard region X and Y coordinate value range enumerated in the coordinate/scan code conversion table, converts the X and Y coordinate values into a scan code corresponding to the specific X and Y coordinate value range.
- [159] If the X and Y coordinate values do not correspond to any keyboard region X and Y coordinate value range, the key input API call program 634 does not convert the X and Y coordinate values into a scan code. If the digital pen application has been activated by the second information communication terminal 630, the key input API call program 634 transmits the X and Y coordinate values to the digital pen application.
- [160] When the key input API call program 634 includes the pattern ID/scan code conversion table, the key input API call program 634 receives a pattern ID from the digital pen driver 632 when activated by the second information communication terminal 630. Then, the key input API call program 634 compares the pattern ID with the pattern ID/scan code conversion table and, if the pattern ID corresponds to a specific pattern ID enumerated in the pattern ID/scan code conversion table, converts the pattern ID into a scan code corresponding to the specific pattern ID.

- [161] If the pattern ID does not coincide with any pattern ID enumerated in the pattern ID/scan code conversion table, the key input API call program 634 does not convert the pattern ID into a scan code. If the digital pen application has been activated by the second information communication terminal 630, the key input API call program 634 transmits the pattern ID to the digital pen application.
- [162] 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

- [163] As mentioned above, according to the present invention, a keyboard emulator is realized by using digital paper having a number of X and Y coordinate values or pattern IDs assigned on its surface and a digital pen for recognizing the X and Y coordinate values or pattern IDs printed on the digital paper. The keyboard emulator can be carried conveniently. In addition, the size of the keyboard realized on the digital paper, as well as the number of keys of the keyboard, can be variously selected.

Claims

- [1] A system for realizing a keyboard emulator by using digital paper and a digital pen, the system comprising:
 keyboard emulator digital paper comprising digital paper displaying position display patterns comprising a number of unit cell patterns, a number of keyboard region coordinate values being assigned to some or all position display patterns of the digital paper;
 a keyboard emulator/digital pen storing a keyboard region coordinate value range regarding the keyboard region coordinate values so that, when one of the keyboard region coordinate values is recognized from the keyboard emulator digital paper, the keyboard emulator/digital pen confirms that the recognized keyboard region coordinate value belongs to the keyboard region coordinate value range and transmits scan code conversion request information and the keyboard region coordinate value, the scan code conversion request information indicating that the keyboard region coordinate value is a key input of a keyboard or a keypad; and
 an information communication terminal comprising a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal receiving the scan code conversion request information and the keyboard region coordinate value from the keyboard emulator/digital pen and converting the keyboard region coordinate value into a scan code of the keyboard or the keypad by means of the keyboard emulator/digital pen driver.
- [2] The system as claimed in claim 1, wherein the keyboard emulator digital paper displays keys of the keyboard or the keypad on a surface so that the keys can be identified by the naked eye.
- [3] The system as claimed in claim 1, wherein each 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 keyboard region coordinate value 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.
- [4] The system as claimed in claim 1, wherein the unit cell pattern comprises $N \times M$ cells (N and M are integers, $N=M$ or $N \neq M$).
- [5] The system as claimed in claim 3, wherein the position of each first cell within the unit cell pattern indicates the positional number of data indicating the coordinate value or the keyboard-dedicated region coordinate value.
- [6] The system as claimed in claim 3, 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.
- [7] The system as claimed in claim 3, wherein errors of the keyboard region coordinate values are corrected by using a value of data corresponding to the second cells within the unit cell pattern.
- [8] The system as claimed in claim 1, wherein the keyboard emulator/digital pen comprises:
 an optical system/lens for optically inputting the position display patterns;
 an image sensor for recognizing images of the inputted position display patterns;
 a microprocessor for processing information inputted from the image sensor;
 an internal memory storing predetermined information under the control of the microprocessor; and
 a USB interface for communicating with an external device under the control of the microprocessor,
 the internal memory stores the keyboard region coordinate value range, the optical system/lens and the image sensor recognize the unit cell pattern of the keyboard emulator digital paper, the microprocessor combines data within the unit cell pattern and processes the data into the keyboard region coordinate value, the microprocessor compares the keyboard region coordinate value with the keyboard region coordinate value range and, when it is confirmed that the keyboard region coordinate value is positioned within the keyboard region coordinate value range, creates the scan code conversion request information, and the microprocessor transmits the keyboard region coordinate value and the scan code conversion request information to the information communication terminal via the USB interface.
- [9] The system as claimed in claim 1, wherein the information communication terminal comprises a BIOS and a buffer, and the keyboard emulator/digital pen driver transmits the scan code to the BIOS or the buffer.
- [10] The system as claimed in claim 1, wherein the information communication terminal comprises a personal computer, a PDA, and a mobile communication terminal.

- [11] The system as claimed in claim 1, wherein the keyboard emulator/digital pen driver comprises a coordinate/scan code conversion table for converting the keyboard region coordinate value into the scan code.
- [12] The system as claimed in claim 1, wherein, when the keyboard region coordinate values are assigned to some of the position display patterns of the digital paper, the digital paper assigns normal coordinate values to remaining position display patterns, and the normal coordinate values are used by a digital pen application, the information communication terminal using the digital pen application to display a handwriting or picture entered into the digital paper by the keyboard emulator/digital pen.
- [13] The system as claimed in claim 12, wherein, when the keyboard emulator/digital pen recognizes the normal coordinate values, the keyboard emulator/digital pen confirms that the normal coordinate values do not belong to the keyboard region coordinate value range and transmits the coordinate values to the information communication terminal, and the information communication terminal uses the normal coordinate values in connection with the digital pen application when the normal coordinate values are received while the digital pen application is activated.
- [14] A system for realizing a keyboard emulator by using digital paper and a digital pen, the system comprising:
 keyboard emulator digital paper comprising digital paper displaying position display patterns comprising a number of unit cell patterns, a number of keyboard region coordinate values being assigned to some or all position display patterns of the digital paper;
 a keyboard emulator/digital pen for recognizing one of the keyboard region coordinate values from the keyboard emulator digital paper and transmitting the recognized keyboard region coordinate value; and
 an information communication terminal storing a keyboard region coordinate value range corresponding to the keyboard-dedicated region, the information communication terminal comprising a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal confirming that the keyboard region coordinate value belongs to the keyboard region coordinate value range, when the keyboard region coordinate value is received from the keyboard emulator/digital pen, and converting the keyboard region coordinate value into a scan code of a keyboard or a keypad by means of the keyboard emulator/digital pen driver.
- [15] The system as claimed in claim 14, wherein the keyboard emulator/digital pen

- driver comprises a coordinate/scan code conversion table for converting the keyboard region coordinate value into the scan code.
- [16] The system as claimed in claim 14, wherein, when the keyboard region coordinate values are assigned to some of the position display patterns of the digital paper, the digital paper assigns normal coordinate values to remaining position display patterns, and the normal coordinate values are used by a digital pen application, the information communication terminal using the digital pen application to display a handwriting or picture entered into the digital paper by the keyboard emulator/digital pen.
- [17] The system as claimed in claim 16, wherein, when the keyboard emulator/digital pen recognizes the normal coordinate values, the keyboard emulator/digital pen transmits the normal coordinate values to the information communication terminal, and the information communication terminal confirms that the normal coordinate values do not belong to the keyboard region coordinate value range, when the normal coordinate values are received from the keyboard emulator/digital pen while the digital pen application is activated, and uses the normal coordinate values in connection with the digital pen application.
- [18] A system for realizing a keyboard emulator by using digital paper and a digital pen, the system comprising:
 keyboard emulator digital paper comprising digital paper comprising a unit cell pattern displaying at least one code of data expressed based on a numeral system having a radix of 2 or larger, the keyboard emulator digital paper comprising a keyboard-dedicated unit cell pattern displaying at least one keyboard-dedicated code, the keyboard-dedicated code being a code of data expressed in a manner different from the code of data of the digital paper, the keyboard emulator digital paper displaying a keyboard-dedicated pattern comprising the keyboard-dedicated unit cell pattern, regions of the keyboard emulator digital paper being distinguished by a keyboard-dedicated coordinate value assigned to the keyboard-dedicated unit cell pattern;
 a keyboard emulator/digital pen comprising a digital pen for recognizing the code of data from the digital paper and processing the code of data into a coordinate value of the digital paper, the keyboard emulator/digital pen storing the keyboard-dedicated code and the keyboard-dedicated coordinate value, recognizing the keyboard-dedicated code from the keyboard emulator/digital paper, processing the recognized keyboard-dedicated code into the keyboard-dedicated coordinate value, and transmitting scan code conversion request information and the keyboard-dedicated coordinate value, the scan code conversion request information indicating that the keyboard-dedicated coordinate

value is a key input of a keyboard or a keypad; and
an information communication terminal having a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal receiving the scan code conversion request information and the keyboard-dedicated coordinate value from the keyboard emulator/digital pen and converting the keyboard-dedicated coordinate value into a scan code of the keyboard or the keypad by means of the keyboard emulator/digital pen driver.

- [19] The system as claimed in claim 18, wherein the keyboard-dedicated pattern comprises:
first cells displaying the keyboard-dedicated codes;
second cells displaying codes of data in a manner distinguished from the first cells or having no codes of data; and
a keyboard-dedicated 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 keyboard-dedicated unit cell pattern indicates the keyboard-dedicated coordinate value of the corresponding keyboard-dedicated unit cell pattern, and the keyboard-dedicated unit cell pattern is separated and distinguished from other adjacent keyboard-dedicated unit cell patterns by the second cells within the keyboard-dedicated unit cell pattern.
- [20] The system as claimed in claim 18, wherein the keyboard-dedicated codes are displayed at the first cells of the keyboard emulator digital paper by using a length or a position different from the codes of data.
- [21] The system as claimed in claim 18, wherein the keyboard-dedicated unit cell pattern comprises $N \times M$ cells (N and M are integers, $N=M$ or $N \neq M$).
- [22] The system as claimed in claim 19, wherein the position of each first cell within the keyboard-dedicated unit cell pattern indicates the positional number of data indicating the keyboard-dedicated coordinate value.
- [23] The system as claimed in claim 19, wherein the number of the second cells within the keyboard-dedicated 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.
- [24] The system as claimed in claim 19, wherein errors of the keyboard-dedicated coordinate value are corrected by using a value of data corresponding to the second cells within the keyboard-dedicated unit cell pattern.
- [25] The system as claimed in claim 18, wherein the keyboard emulator/digital pen comprises:

an optical system/lens for optically inputting a position display pattern belonging to the digital paper or the keyboard-dedicated pattern belonging to the keyboard emulator digital paper;
 an image sensor for recognizing an image of the inputted position display pattern or the keyboard-dedicated pattern;
 a microprocessor for processing information inputted from the image sensor;
 an internal memory storing predetermined information under the control of the microprocessor; and
 a USB interface for communicating with an external device under the control of the microprocessor,
 the internal memory stores the keyboard-dedicated codes and the keyboard-dedicated coordinate value, the optical system/lens and the image sensor recognize the keyboard-dedicated codes of the keyboard-dedicated unit cell pattern, the microprocessor combines dedicated code data, the dedicated code data being data corresponding to the keyboard-dedicated codes, and processes the keyboard-dedicated codes into the keyboard-dedicated coordinate, and the microprocessor creates the scan code conversion request information and transmits the keyboard-dedicated coordinate value and the scan code conversion request information to the information communication terminal via the USB interface.

- [26] The system as claimed in claim 18, wherein the information communication terminal comprises a BIOS and a buffer, and the keyboard emulator/digital pen driver transmits the scan code to the BIOS or the buffer.
- [27] The system as claimed in claim 18, wherein the keyboard emulator/digital pen driver comprises a coordinate/scan code conversion table for converting the keyboard-dedicated coordinate value into the scan code.
- [28] The system as claimed in claim 18, wherein, when the keyboard emulator/digital pen recognizes the code of data from the digital paper, the keyboard emulator/digital pen processes the code of data into the coordinate value and transmits only the coordinate value to the information communication terminal.
- [29] A system for realizing a keyboard emulator by using digital paper and a digital pen, the system comprising:
 keyboard emulator digital paper comprising digital paper comprising a unit cell pattern displaying at least one code of data expressed based on a numeral system having a radix of 2 or larger, the keyboard emulator digital paper comprising a keyboard-dedicated unit cell pattern displaying at least one keyboard-dedicated code, the keyboard-dedicated code being a code of data expressed in a manner different from the code of data of the digital paper, the keyboard emulator digital

paper displaying a keyboard-dedicated pattern comprising the keyboard-dedicated unit cell pattern, regions of the keyboard emulator digital paper being distinguished by a keyboard-dedicated coordinate assigned to the keyboard-dedicated unit cell pattern;

a keyboard emulator/digital pen for recognizing the code of data from the digital paper or recognizing the keyboard-dedicated code from the keyboard emulator digital paper and transmitting the code of data or the keyboard-dedicated code; and

an information communication terminal storing the keyboard-dedicated code and the keyboard-dedicated coordinate value and comprising a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal processing the keyboard-dedicated code into the keyboard-dedicated coordinate value, when the keyboard-dedicated code is received from the keyboard emulator/digital pen, and converting the keyboard-dedicated coordinate value into a scan code of a keyboard or a keypad by means of the keyboard emulator/digital pen driver.

- [30] The system as claimed in claim 29, wherein the keyboard emulator/digital pen driver comprises a coordinate/scan code conversion table for converting the keyboard-dedicated coordinate value into the scan code.
- [31] The system as claimed in claim 29, wherein, when the information communication terminal receives the code of data from the keyboard emulator/digital pen while a digital pen application is activated, the information communication terminal processes the code of data into the coordinate value and uses the coordinate value in connection with the digital pen application.
- [32] A system for realizing a keyboard emulator by using digital paper and a digital pen, the system comprising:
 keyboard emulator digital paper comprising digital paper comprising a unit cell pattern comprising at least one first cell displaying a code of data expressed based on a numeral system having a radix of 2 or larger and an object display pattern comprising at least one unit cell pattern, regions of the digital paper being distinguished by a pattern ID assigned to the object display pattern, the keyboard emulator digital paper comprising the object display pattern assigned a keyboard-dedicated pattern ID, the keyboard-dedicated pattern ID being a pattern ID specific to each key of a keyboard or a keypad;
 a keyboard emulator/digital pen comprising a digital pen for recognizing a coordinate value or the pattern ID from the digital paper, the keyboard emulator/digital pen recognizing the code of data from the keyboard emulator digital

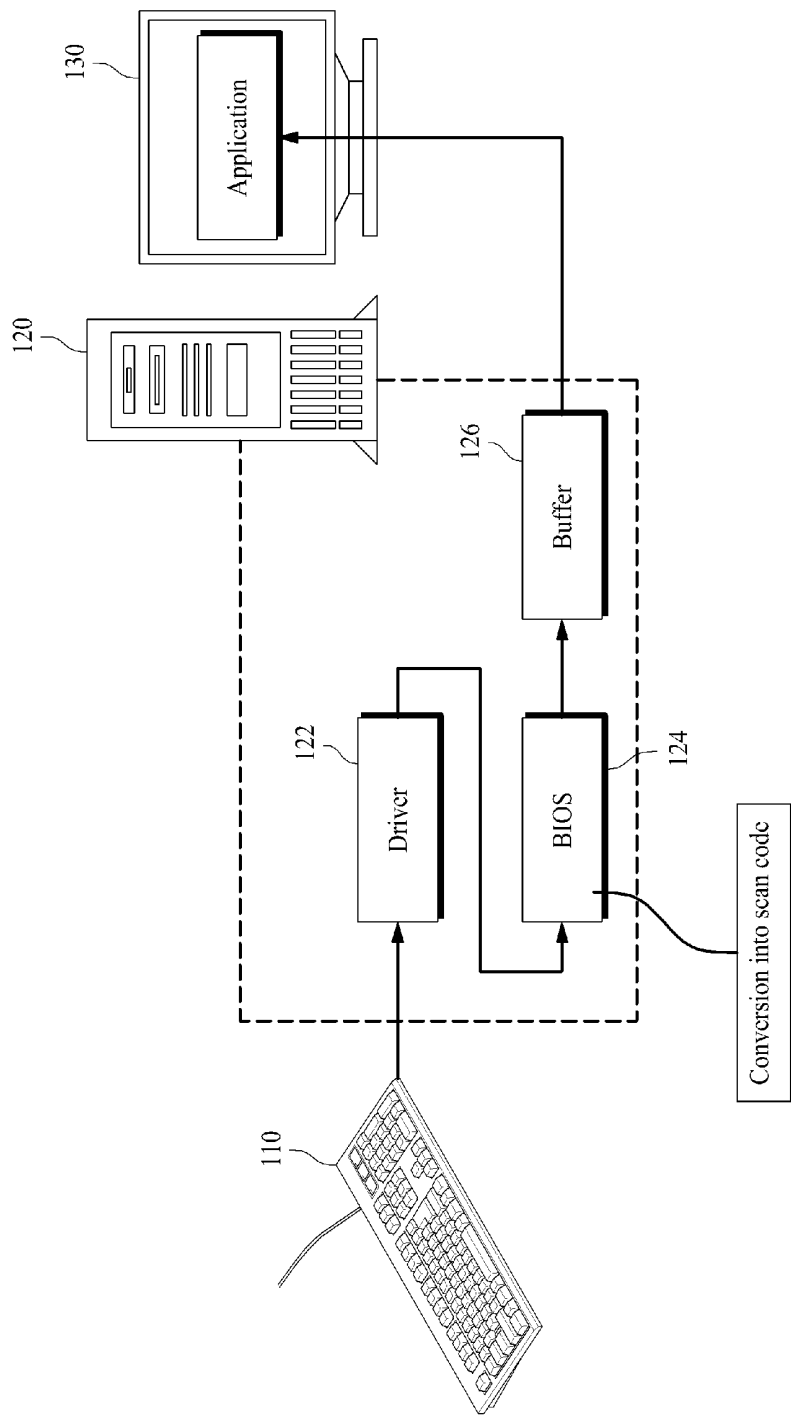
- paper, processing the code of data into the keyboard-dedicated pattern ID, and transmitting the keyboard-dedicated pattern ID; and
an information communication terminal having a keyboard emulator/digital pen driver, the keyboard emulator/digital pen driver being a driver of the keyboard emulator/digital pen, the information communication terminal receiving the keyboard-dedicated pattern ID from the keyboard emulator/digital pen and converting the keyboard-dedicated pattern ID into a scan code of the keyboard or the keypad by means of the keyboard emulator/digital pen driver.
- [33] The system as claimed in claim 32, wherein the unit cell pattern comprises the first cells and second cells displaying the data after encoding in a manner distinguished from the first cells or having no data, and a combination of data corresponding to the first cells within the unit cell pattern indicates the keyboard-dedicated pattern ID.
- [34] The system as claimed in claim 33, wherein the unit cell pattern is separated and distinguished from other adjacent unit cell patterns by the second cells within the unit cell pattern, and at least one unit cell pattern having an identical keyboard-dedicated pattern ID constitutes an object display pattern.
- [35] The system as claimed in claim 32, wherein the unit cell pattern comprises NxM cells (N and M are integers, $N=M$ or $N \neq M$).
- [36] The system as claimed in claim 32, wherein the position of each first cell within the unit cell pattern indicates the positional number of data indicating the keyboard-dedicated pattern ID.
- [37] The system as claimed in claim 32, wherein the keyboard emulator/digital pen comprises:
an optical system/lens for optically inputting the unit cell pattern belonging to the digital paper or the keyboard emulator digital paper;
an image sensor for recognizing an image of the inputted unit cell pattern;
a microprocessor for processing information inputted from the image sensor;
an internal memory storing predetermined information under the control of the microprocessor; and
a USB interface for communicating with an external device under the control of the microprocessor,
the optical system/lens and the image sensor recognize the unit cell pattern, the microprocessor combines data corresponding to the first cells within the unit cell pattern, processes the data into the keyboard-dedicated pattern ID, and transmits the keyboard-dedicated pattern ID to the information communication terminal.
- [38] The system as claimed in claim 32, wherein the information communication terminal comprises a BIOS and a buffer, and the keyboard emulator/digital pen

- driver transmits the scan code to the BIOS or the buffer.
- [39] The system as claimed in claim 32, wherein the keyboard emulator/digital pen driver comprises a pattern ID/scan code conversion table for converting the keyboard-dedicated pattern ID into the scan code.
- [40] A system for realizing a keyboard emulator by using digital paper and a digital pen, the system comprising:
digital paper displaying a position display pattern comprising a number of unit cell patterns, regions of the digital paper being distinguished by a coordinate value or pattern ID assigned to the unit cell patterns;
a digital pen for recognizing the coordinate value or the pattern ID from the digital paper; and
an information communication terminal having a digital pen driver and a key input API call program, the digital pen driver being a driver of the digital pen, the information communication terminal receiving the coordinate value or the pattern ID from the digital pen by means of the digital pen driver, the information communication terminal converting a coordinate value or a pattern ID within a part or the entire region of the digital paper into a scan code of a keyboard or a keypad by means of the key input API call program when the coordinate value or the pattern ID within a part or the entire region of the digital paper is received while the key input API call program is activated.
- [41] The system as claimed in claim 40, wherein the digital paper has keys of the keyboard or the keypad displayed on a surface of a part or the entire region of the digital paper so that the keys can be identified by the naked eye.

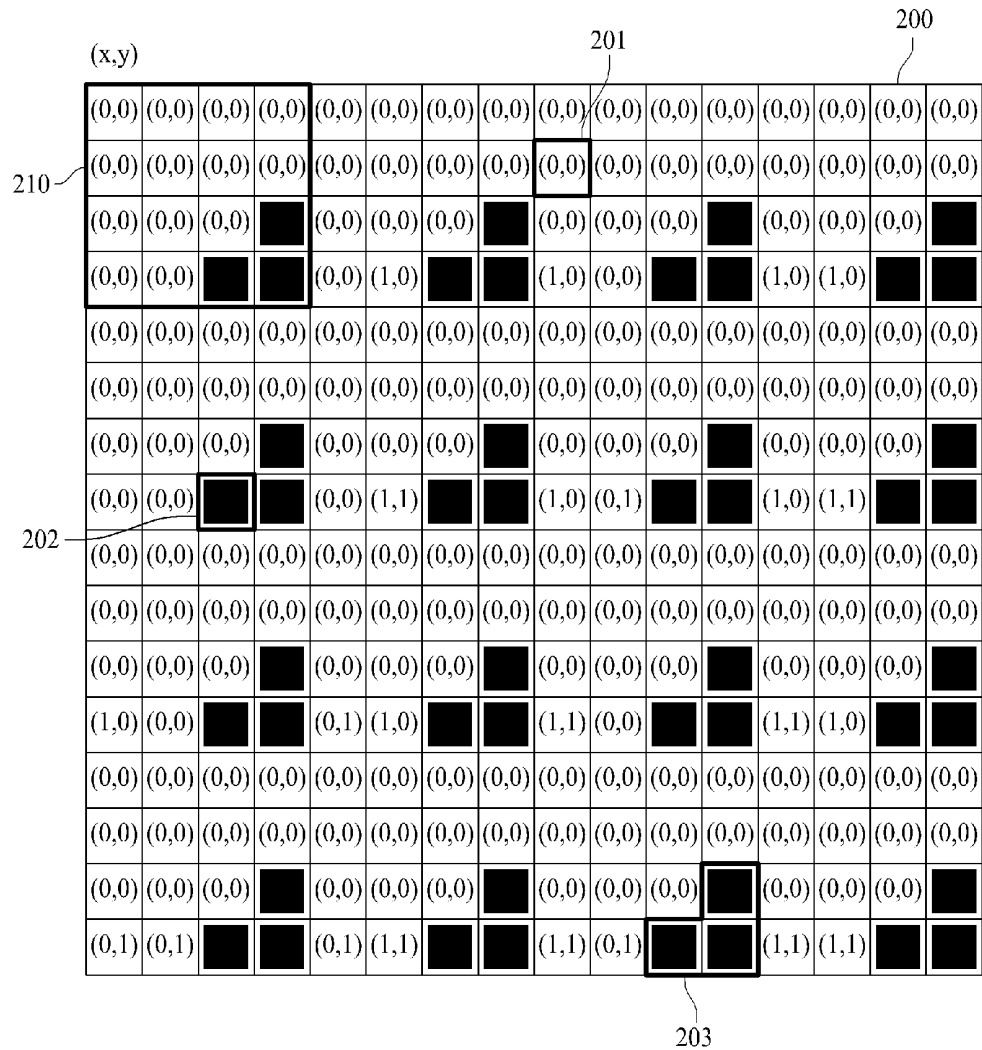
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PCT/KR2008/001778

[Fig. 1]



[Fig. 2]



[Fig. 3]

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. 4]

13	9	5	2
12	8	4	1
11	7	3	■
10	6	■	■

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[Fig. 5]

	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. 6]

1	1	1	1	1	1	1	1	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		

[Fig. 7]

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		

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[Fig. 8]

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

[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	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. 10]

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		

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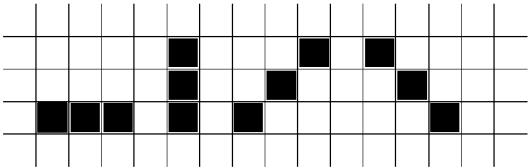
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[Fig. 11]

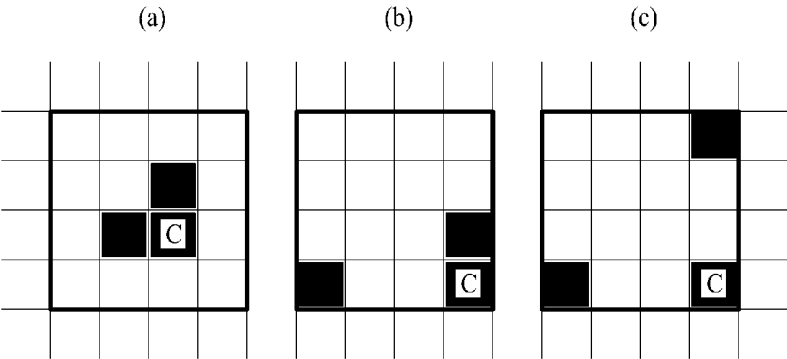
(x,y)

(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)	(0,0)	■	■	(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. 12]



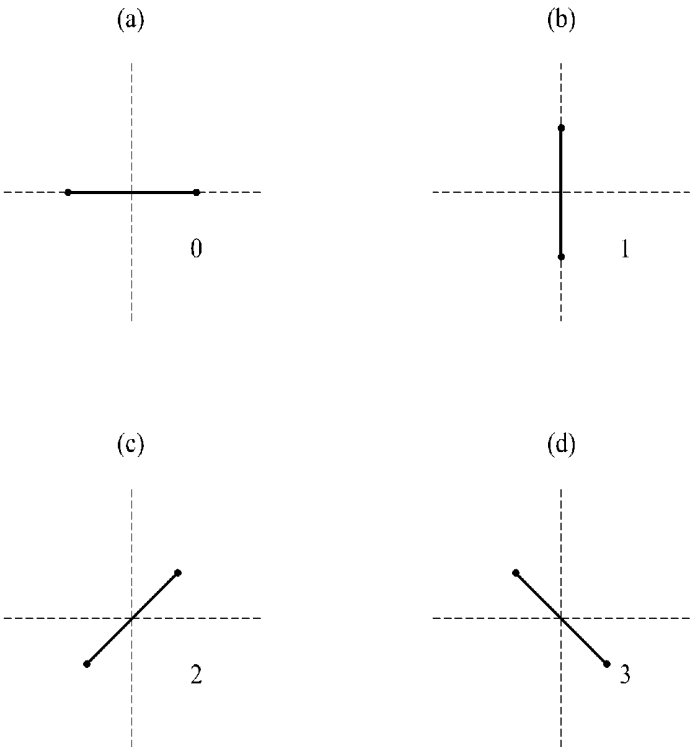
[Fig. 13]



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[Fig. 14]



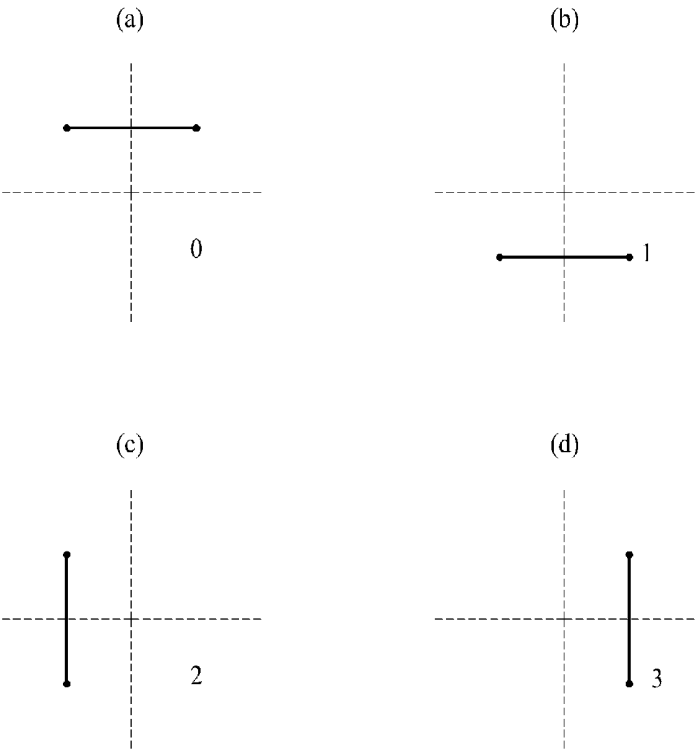
[Fig. 15]

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

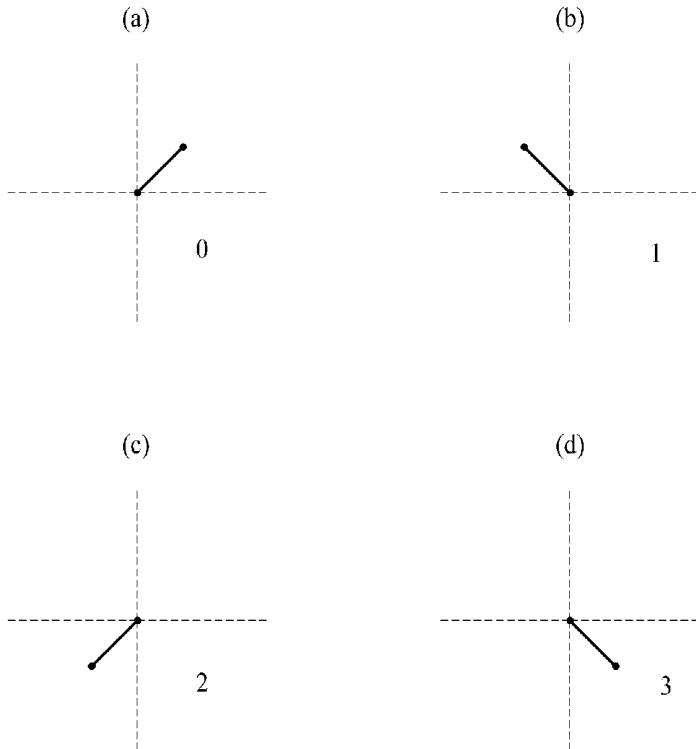
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[Fig. 16]



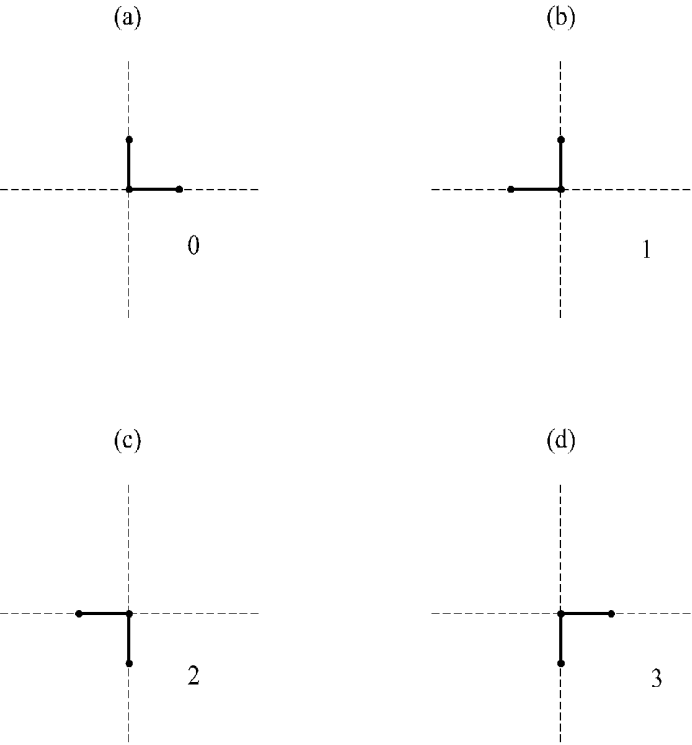
[Fig. 17]



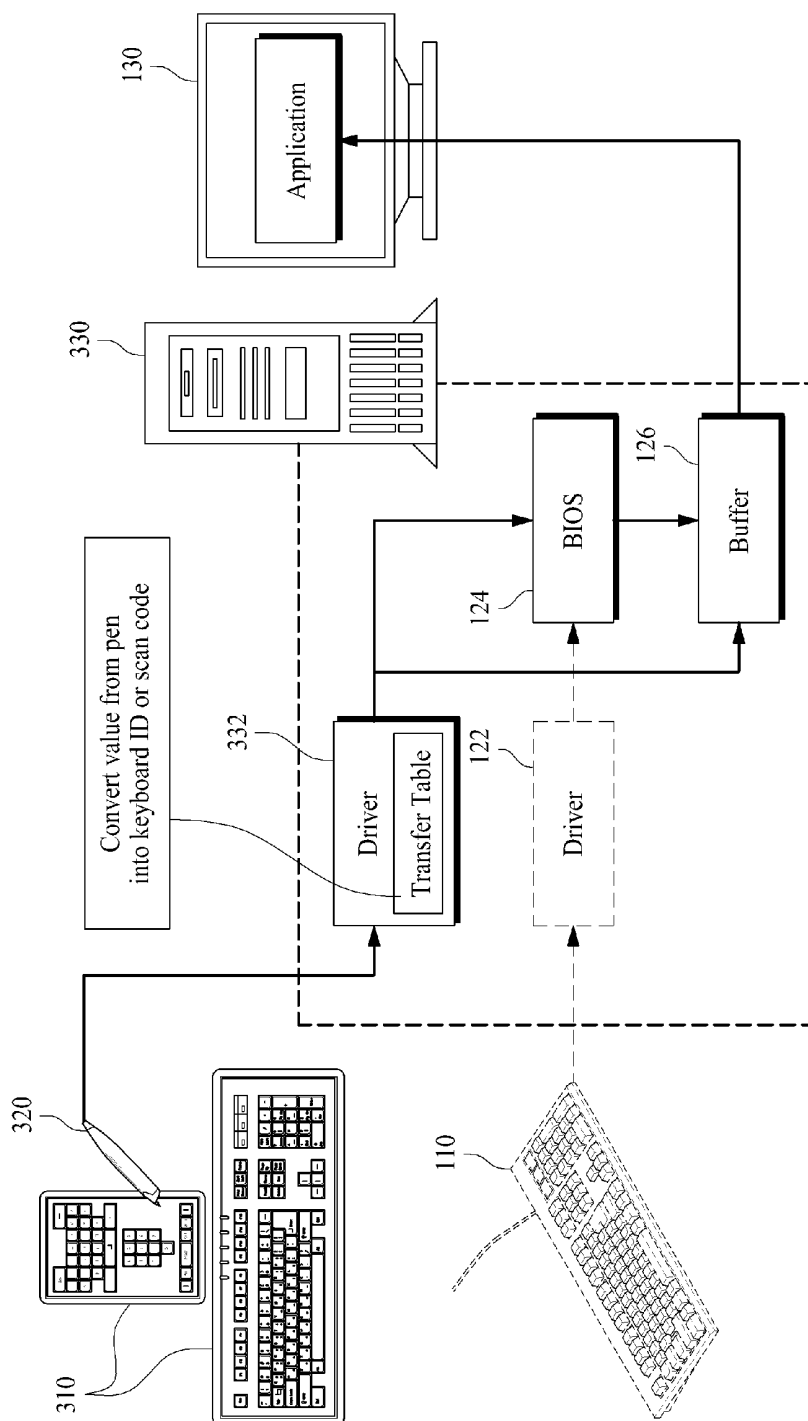
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[Fig. 18]



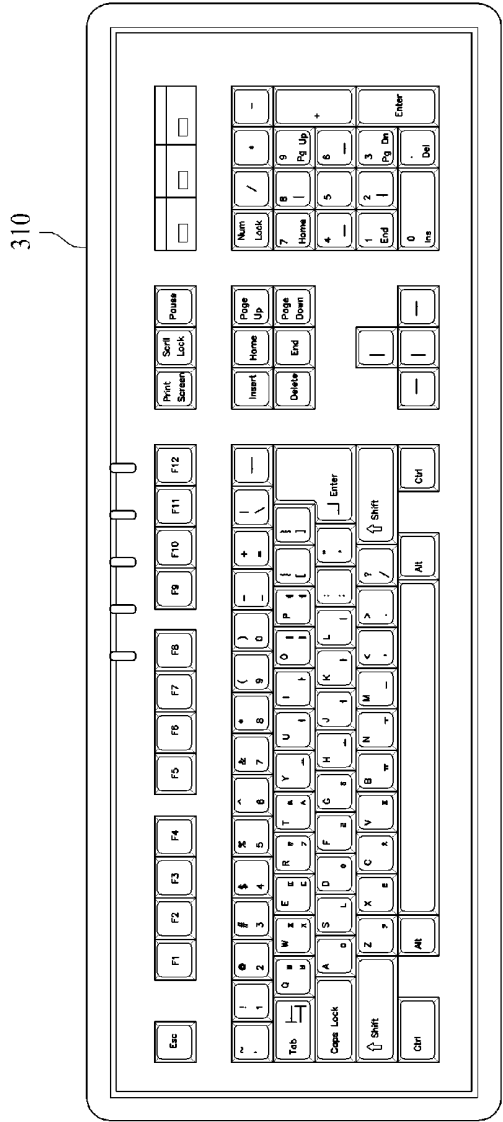
[Fig. 19]



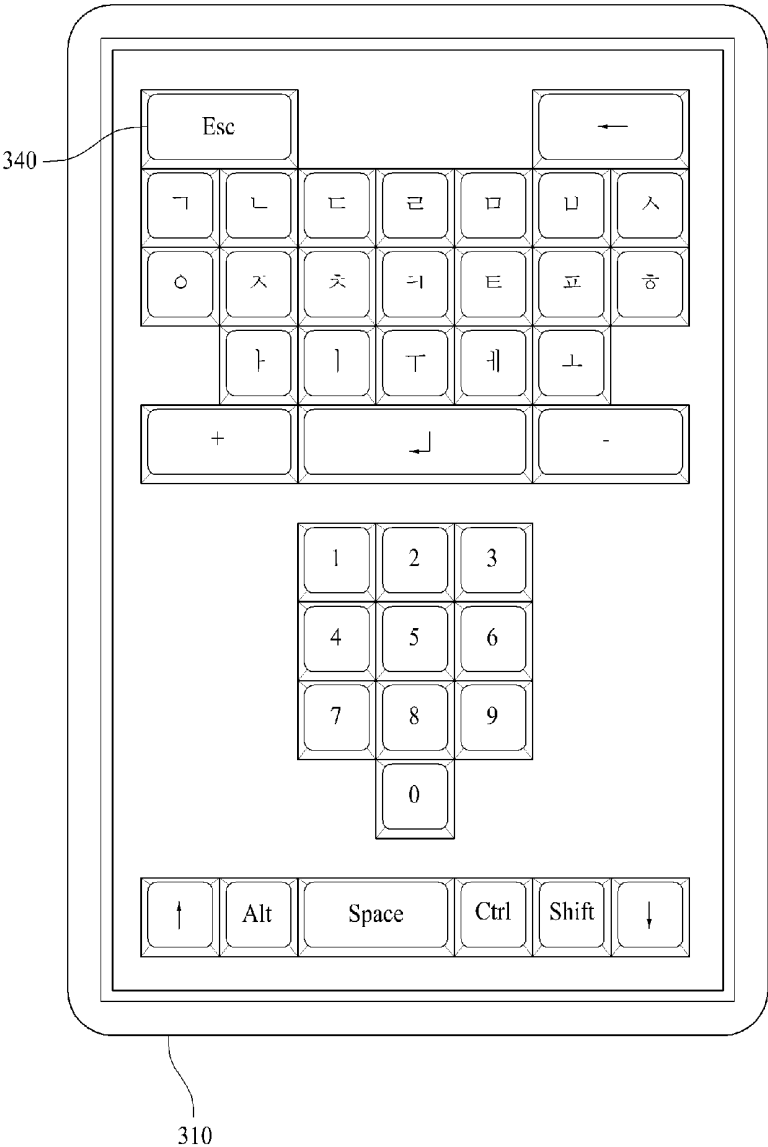
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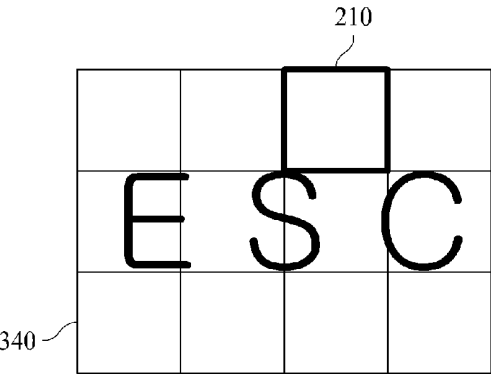
[Fig. 20]



[Fig. 21]



[Fig. 22]



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[Fig. 23]

When coordinate value is used

Pattern ID (x Range, y Range)	Corresponding Key Scan Code
(101~120, 21~40)	1
(126~145, 21~40)	2
(151~170, 21~40)	3
•••••	•••••
(101~120, 1~20)	F1
(101~120, 1~20)	F2
•••••	•••••
(x1~x2, y1~y2)	ㅊ, Q, q
(x1~x2, y1~y2)	ㅊ, W, w
•••••	•••••
(x1~x2, y1~y2)	Tab
(x1~x2, y1~y2)	Caps Lock
(x1~x2, y1~y2)	Shift
•••••	•••••
(x1~x2, y1~y2)	Space

[Fig. 24]

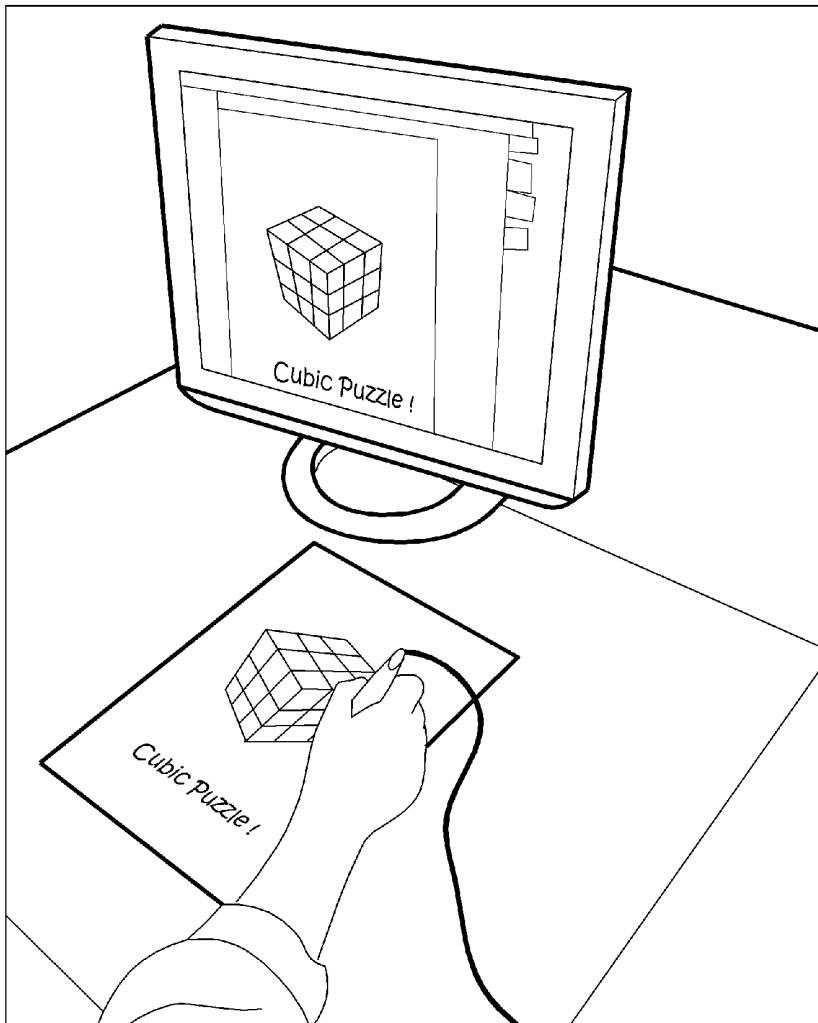
When key's own pattern is used

Pattern ID	Corresponding Key Scan Code
000	0
001	1
002	2
•••••	•••••
010	F1
011	F2
•••••	•••••
031	ㅊ, Q, q
032	ㅊ, W, w
•••••	•••••
071	Tab
072	Caps Lock
073	Shift
•••••	•••••
200	Space

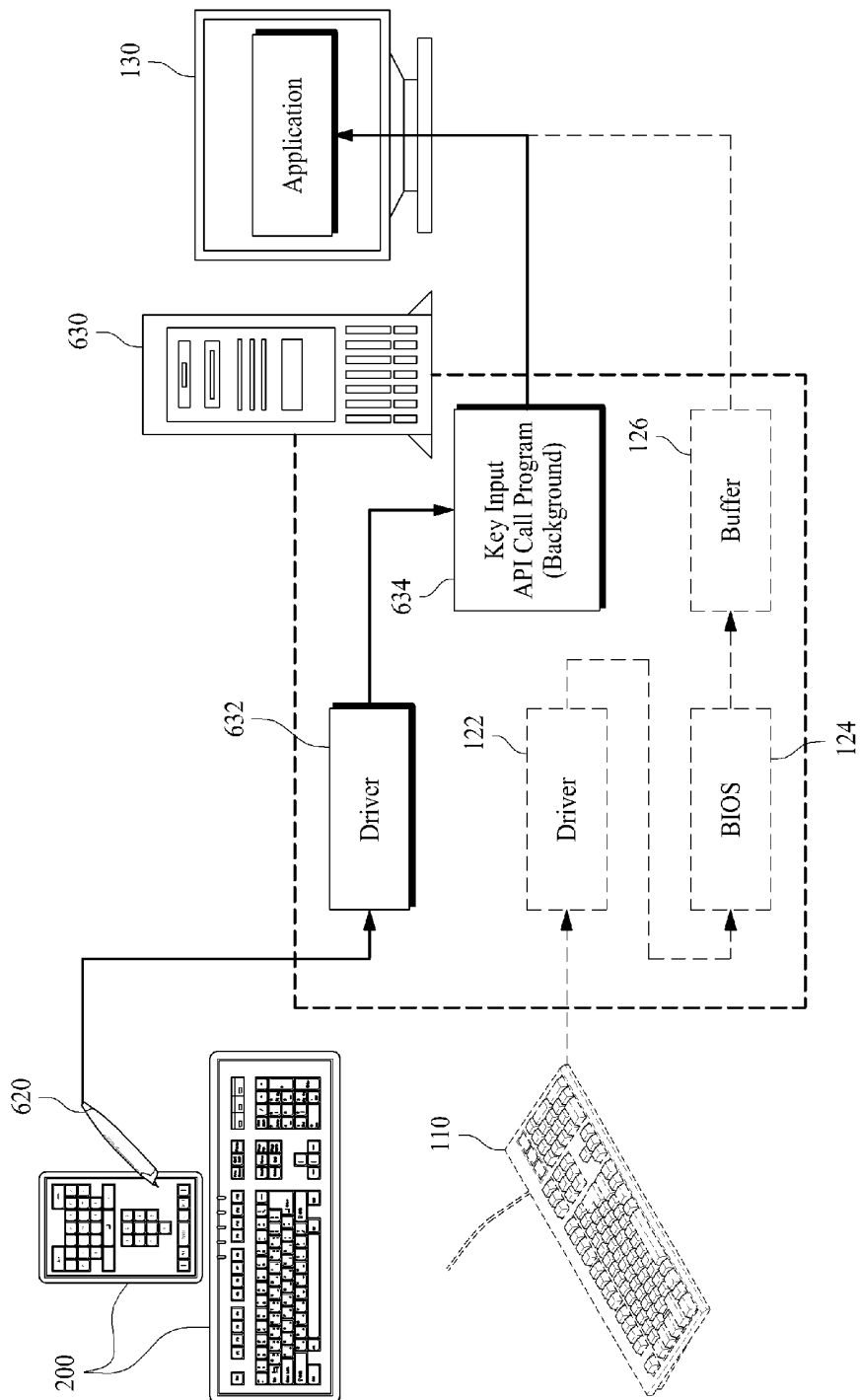
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[Fig. 25]



[Fig. 26]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/001778
A. CLASSIFICATION OF SUBJECT MATTER
G06F 3/033(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

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) " Keyword : (digit, alphabet, spell), (pen, paper), (keyboard, keypad), (input) "

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2004-303155 A (CANON INC.) 28 Oct. 2004 Abstract, Claims 1-8, Figs. 1,3-11, Paragraphs [0001]-[0022]	1-3,5-7,9-11,14-15,18-20,22-24,26-34,36,38-41
Y1 Y1		4,8,21,25,35,37 12,13,16,17
Y2 A	JP 2002-082763 A (SHARP CORP.) 22 Mar. 2002 Abstract, Claims 1-2, Figs. 1-5,7-13, Paragraphs [0001]-[0038]	4,8,21,25,35,37 1-3,5-7,9-20,22-24,26-34,36,38-41
Y2 A	JP 2004-145408 A (HITACHI LTD.) 20 May 2004 Abstract, Claims 1-6, Figs. 1-5, Paragraphs [0001]-[0010]	12,13,16,17 1-11,14-15,18-41
A	JP 05-094253 A (SHARP CORP.) 16 Apr. 1993 Abstract, Claims 1, Figs. 1,2, Paragraphs [0001]-[0011]	1-41



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

08 AUGUST 2008 (08.08.2008)

Date of mailing of the international search report

08 AUGUST 2008 (08.08.2008)

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Facsimile No. 82-42-472-7140

Authorized officer

CHUN, Dae Sik

Telephone No. 82-42-481-5871



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/001778

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2004-303155 A	28.10.2004	None	
JP 2002-082763 A	22.03.2002	None	
JP 2004-145408 A	20.05.2004	None	
JP 05-094253 A	16.04.1993	None	