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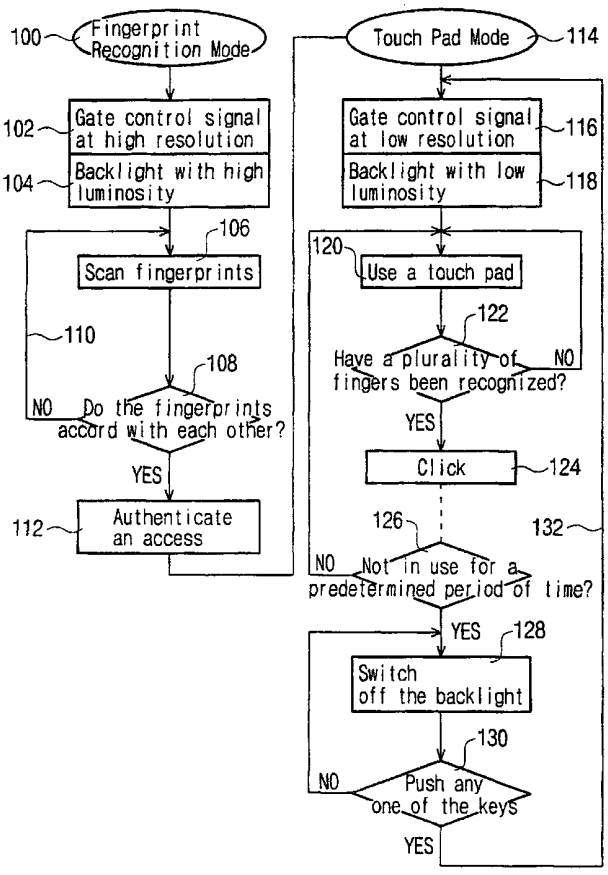

(57) Abstract: Disclosed are a method of implementing a touch pad by using a conventional TFT type fingerprint reader and a touch pad apparatus adopting the same method, which is capable of scanning fingerprints, locating positions of fingers and executing a clicking function. The method of implementing a touch pad by using a fingerprint reader is characterized by realizing a fingerprint recognition mode and a touch pad mode by means of a TFT type fingerprint reader (hereinafter, referred to as "a fingerprint reader") structured to have a plurality of unit cells arrayed therein to include a sensor TFT and a switching TFT in each unit cell for scanning fingerprints image, and a backlight positioned beneath the fingerprint reader for illuminating a light so as to penetrate the fingerprint reader.

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A METHOD OF IMPLEMENTING TOUCH PAD BY USING FINGERPRINT READER AND A TOUCH PAD APPARATUS ADOPTING THE SAME METHOD

Technical Field

The present invention relates to a method of implementing a touch pad by using a fingerprint reader and a touch pad apparatus adopting the same method.

Background Art

Touch Pad

A mouse is widely used in addition to the conventional keyboard as a computer input apparatus with the recent popularity of a graphic user interfacing method as a computer input apparatus. The mouse is used for diverse purposes of executing an entry function with respect to a corresponding menu while moving a cursor on a monitor screen to pull down a particular menu. The technical development of a mouse was led to an invention of a touch pad, which is mainly used for a notebook computer or a wireless keyboard.

The touch pad is an input apparatus that performs entry by laying a finger on a fixed finger touch window to move a cursor and by pushing the finger. The following is a description of the structure and function of the touch pad made with reference to Fig. 1.

The touch pad comprises a plurality of layers. The top layer is a touch pad 1 for being touched by a finger. Electrode layers are positioned beneath the touch pad 1. Electrodes 3 are vertically arrayed on an upper electrode layer 2, while electrodes 3' are horizontally arrayed on a lower electrode layer 4. A slim insulation layer 5 is disposed between the upper electrode layer 2 and the lower electrode layer 4 to form a lattice under

the state of insulating the electrodes 3, 3'. A pressure sensor 6 is positioned beneath the lower electrode layer 4 to output an electric signal.

The electrode layers 2, 4 are charged by a predetermined alternate current. If a finger touches the pad 1 and approaches the electrode lattice, the current of the corresponding lattice is interrupted. A control section senses the interruption of the current, and recognizes a positional shift of the finger.

The positional shift of the finger is displayed as a motion of the cursor on a computer monitor screen. The pressure sensor 6 executes a clicking or an entry function instead of the conventional mouse or a trackball. In other words, if a user pushes or taps the pad 1 with his/her finger, the pressure sensor 6 at the bottom of the touch pad outputs an electric signal in response thereto. The computer receives the output signal from the pressure sensor 6, and recognizes that the user has executed either a clicking or an entry function.

The touch pad shown in Fig. 1 is operated under a mechanism of discharging of the charge between the lattice by means of the charge existing on the finger. Therefore, the touch pad does not operate when using a substance (pens, etc.) other than the finger.

TFT Type Fingerprint Input Apparatus

Under the conventional technology, authentication of an access was available with a password when a user wishes to acquire permission for an access as a computer security device. A fingerprint recognition system has also been developed to authenticate an access by recognizing a pre-registered fingerprint of a user. The fingerprint recognition system is a system of authenticating an access by illuminating a light onto a fingerprint, interprets a reflected fingerprint image, and by comparing the interpreted fingerprint image with a fingerprint stored in a database.

The conventional fingerprint recognition system is classified into an optical style and a semiconductor style. The optical style has an advantage of reflecting a high quality fingerprint image. However, it has drawbacks of distorting the fingerprint images and being difficult to reduce its size as well as of incurring a high cost. The semiconductor style has advantages of incurring a low cost as it can be manufactured by a CMOS processing and being reducible to a compact size. However, it also has a drawback of being vulnerable to static electricity or other external environment.

A fingerprint reader was recently developed by using a photosensitive thin film transistor (TFT). The fingerprint reader is a kind of a touch-type image sensor using a photosensitivity of an amorphous silicon (a-Si:H) that can obtain a high photosensitivity with a relatively slim structure.

The following is a brief description of an operational mechanism of the TFT type fingerprint reader made with reference to Figs. 2A and 2B. Fig. 2A is a longitudinal section view of the TFT type fingerprint reader in a unit cell. Fig. 2B is an equivalent circuit, in which four unit cells having the same construction as the fingerprint reader are arrayed.

Referring to Fig. 2A, the TFT type fingerprint reader 10 according to the present invention comprises a transparent substrate 11, a sensor TFT 12 and a switching TFT 13 on the transparent substrate 11. A backlight illuminates a light upward to penetrate the fingerprint reader 10. A source electrode 12-S of the sensor TFT 12 is electrically connected to a drain electrode 13-D of the switching TFT 13 by means of a first electrode 14. A second electrode 15 is connected to a gate electrode 12-G of the sensor TFT 12. The second electrode 15 is junctionally installed between the first electrode 14 and the transparent insulation layer 16 so as to provide a capacitance Csto between the first electrode 14 and the second electrode 15. The capacitance Csto between the first electrode

14 and the second electrode 15 functions to charge the electric charge in proportion to an amount of the light inputted to the sensor TFT 12. For reference, it is preferable to use transparent electrodes as the first electrode 14 and the second electrode 15.

A photosensitive layer 12-P of a predetermined material (e.g., a-Si:H) is formed between the drain electrode 12-D and the source electrode 12-S of the sensor TFT 12. Therefore, if a light greater than a predetermined amount is received by the photosensitive layer 12-P, the drain electrode 12-D and the source electrode 12-S become electrically conductive. If the user tightly put his/her finger onto the fingerprint reader 10, the light L generated from the backlight 6 of the lower portion of the transparent substrate 11 is reflected in accordance with the fingerprint pattern and received by the photosensitive layer 12-P of the sensor TFT 12. With the conduction of the sensor TFT 12, electric charge is charged in the capacitance Csto in proportion to an amount of the inputted light.

Meanwhile, a light shielding layer 13-Sh is formed on upper portions of the drain electrode 13-D and the source electrode 12-S of the switching TFT 13.

Fig. 2B illustrates an equivalent circuit, in which four unit cells having the same construction as a fingerprint reader are arrayed. A direct current voltage Vccl of a predetermined level is applied to the drain electrode 12-D of the sensor TFT 12, and a bias voltage Vcc2 of a predetermined level is applied to the gate electrode 12-G.

A gate terminal 13-G of the switching TFT 13 is connected to a gate control section (not shown in the drawings) to perform a switching operation upon receipt of a gate control signal. The gate control section forms a frame, in which the fingerprint image inputted through the fingerprint reader 10 is scanned for each arrayed sensor TFT 12 by outputting the gate control signal to switch the switching TFT 13 for each frame set to scan the fingerprint.

Also, the source electrode 13-S of the switching TFT 13 is connected to an amplifying section, which is not shown in the drawings, so as to output voltage proportional to the amount of the electric charge charged in the capacitance Csto, if the switching TFT 13 has been turned on. The signal outputted from the source electrode 13-S is amplified through the amplifying section. A signal output terminal of the amplifying section is connected to a multiplexer to output a mono signal.

Computer Employing a Touch Pad or a Fingerprint Reader

A variety of computers employing a touch pad or a fingerprint reader, either separately or integrally, are being developed in recent days. The touch pad is mainly attached to a compact size portable computer (so called "a notebook computer") or a wireless keyboard, while the fingerprint reader is installed at diverse kinds of computer models. In particular, it is common to install the fingerprint reader at a notebook computer.

An LCD display is often installed at a main body of a portable computer or at a keyboard of a fixed type computer to display short messages. At times, the touch pad, fingerprint reader and the LCD display are installed altogether at a computer depending on a kind of the computer.

Disclosure of Invention

Installation of a touch pad, a fingerprint reader and an LCD display at one computer as described above results in a waste of space within the computer in light of their dominant occupation of the space as well as an increase of the unit cost because each part needs to be installed on a separate basis. Further, a complicated appearance of the computer deteriorates aesthetic effects.

If the TFT type fingerprint reader, the touch pad and the LCD display would be

intergrated into a single unit, the above structural problem could be resolved. Also, new functions could be added, and the appearance of the computer could be reduced. The unit cost could also be lowered and aesthetics could be provided for the appearance.

It is, therefore, an object of the present invention to provide a method of implementing a touch pad by locating positions of fingers and sensing a clicking in addition to scanning fingerprints image by adopting the same structure as the conventional TFT type fingerprint reader.

It is another object of the present invention to provide a touch pad apparatus capable of functioning a touch pad while recognizing a fingerprint by adopting the same structure as the conventional TFT type fingerprint reader.

Method of Implementing a Touch Pad by Using a TFT type fingerprint reader

The present invention relates to a method of implementing a touch pad by using the conventional TFT type fingerprint reader as shown in Fig. 2A. An operational mechanism of the present invention will now be described with reference to Fig. 3A.

Fig. 3A is a top-plan view of the fingerprint reader 10 in Fig. 2A taken from the perspective of a finger touch window. Each unit cell (a sensor TFT and a switching TFT) is arrayed in matrix, and a positional image 17 of the finger in touch is displayed.

If a user touches his/her finger the finger touch window of the fingerprint reader 10, the light reflected by a backlight is incident to a sensor TFT of each unit cell. The photoelectric charge generated at this time is switched by a switching TFT so as to be outputted by an output section. Accordingly, if the fingerprint reader 10 is in a finger recognition mode, the fingerprint is precisely scanned to an eligible extent. If the fingerprint reader 10 is in a touch pad mode, however, only the positional image of the finger needs to be read.

If the position 17 of the finger is as shown in Fig. 3A, photocurrent is generated by the light reflected from the finger and incident to the sensor TFT in a cell only within a corresponding area. The photocurrent will be outputted as a data value different from the area where the finger is not positioned. For instance, the fingerprint reader can be constructed such that "1" is outputted from each cell included within the area where the finger is positioned while "0" is outputted from each cell included within the area where the finger is not positioned.

The output signal of each cell is converted to digital data by means of gray level projection method. The gray level projection method is a technique of considering each cell to be a pixel, and adding output values from each pixel with respect to an X-axis and a Y-axis. A person skilled in the art can easily carry out this technique.

Assuming that the data within the area occupied by the finger is "1", the result of adding the output data from each cell with respect to the X-axis and the Y-axis is expressed by pulse waveforms as identified by the drawing reference numerals 18 and 19 in Fig. 3A. The position of the maximum pulse value of those pulse waveforms in a coordinate is positions of the fingers.

The present invention can be carried out in diverse forms according to the operational mechanism described above.

The first form is a method of realizing a fingerprint recognition mode and a touch pad mode by using a TFT type fingerprint reader (hereinafter, referred to as "a fingerprint reader) for scanning fingerprints image with a structure, in which a plurality of unit cells including a sensor TFT and a switching TFT are arrayed, and a backlight located underneath of the fingerprint for illuminating a light to pass the fingerprint reader. In the fingerprint recognition mode, the fingerprint reader can recognize a fingerprint image by

scanning the fingerprint with its original function. In the touch pad mode, the fingerprint reader can locate positions of the fingers by projectively converting output values of the position of the finger from each unit cell with respect to the X-axis and the Y-axis. Here, the clicking function in the touch pad mode can be realized by recognizing a touch of the fingerprint reader with two fingers.

The second form is a method of realizing the fingerprint recognition mode and the touch pad mode by means of a fingerprint reader, a backlight, and a pressure sensor, which is positioned beneath the backlight to sense the pressure of pushing the fingerprint and outputs electric signals. In the fingerprint recognition mode, the fingerprint image is recognized by scanning the fingerprint with the original function of the fingerprint reader. In the touch pad mode, the position of the finger can be located by projectively converting output values of each unit cell for the position of the finger with respect to the X-axis and the Y-axis. Here, the clicking function of the touch pad is executed by the pressure sensor, which senses the pressure of pushing the fingerprint reader by a finger.

The third form is a method of realizing the fingerprint recognition mode and the touch pad mode by means of an LCD display for displaying characters or messages, and a backlight positioned beneath the LCD display. In the fingerprint recognition mode, the fingerprint image is recognized by scanning the fingerprint with the original function of the fingerprint reader. In the touch pad mode, the position of the finger is located by projectively converting output values of each unit cell for the position of the finger with respect to the X-axis and the Y-axis. Guiding messages area is displayed by the LCD display in the fingerprint recognition mode and in the touch pad mode. Since no pressure sensor is used, the clicking function in the touch pad mode is executed by recognizing a touch of the fingerprint reader with two fingers.

The fourth form is a method of realizing the fingerprint recognition mode and the touch pad mode by means of an LCD display, a backlight, and a pressure sensor. In the fingerprint recognition mode, the fingerprint image is recognized by scanning the fingerprint with the original function of the fingerprint reader. In the touch pad mode, the position of the finger is located by projectively converting output values of each unit cell for the position of the finger with respect to the X-axis and the Y-axis. Guiding messages area is displayed by the LCD display in the fingerprint recognition mode and in the touch pad mode. Here, the clicking function in the touch pad mode is executed by the pressure sensor, which detects pushing the fingerprint reader with a finger.

In any case, it is preferable to scan the fingerprint image at high resolution in the fingerprint recognition mode, and at low resolution in the touch pad mode. It is also preferable to heighten the luminosity in the fingerprint recognition mode, and to lower the luminosity in the touch pad mode to save the electric power.

The touch pad function can be executed by using the TFT type fingerprint reader based on the above operational mechanism. In order to apply such basic mechanism to the applicable products such as a notebook computer so as to be perfect as a system, a control unit is required to implement both the fingerprint recognition mode and the touch pad mode. For instance, the fingerprint recognition mode should operate when a notebook computer is empowered, but the touch pad mode should operate once after an authentication for access has been made.

Since it is unnecessary to accurately read a fingerprint in the touch pad mode, the gate control signal of the switching TFT may be operated at low resolution. Even though an accurate reading of a fingerprint is important by brightly illuminating the backlight in the fingerprint recognition mode, the backlight may be illuminated to be darker to an extent of

locating the position of the finger in the touch pad mode. In the touch pad mode, however, a perfect system can be achieved when an entry function or a clicking function of a mouse is available in addition to the positional shift of the finger.

Brief Description of Drawings

The above 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:

Fig. 1 is a diagram illustrating an operational mechanism of a conventional touch pad;

Fig. 2A is a cross-sectional view of a TFT type fingerprint reader;

Fig. 2B is an equivalent circuit diagram of the TFT type fingerprint reader;

Fig. 3A is a diagram illustrating an operational mechanism of a touch pad according to the present invention;

Fig. 3B is a diagram illustrating an operational mechanism of a clicking function of the touch pad according to the present invention;

Fig. 3C is a pulse diagram illustrating a mechanism of recognizing a clicking by a fingerprint reader when a finger taps a finger touch window twice;

Fig. 4A is a block diagram illustrating a construction of the touch pad according to a first best mode for carrying out the present invention;

Fig. 4B is a flow chart illustrating an operation of the touch pad according to the first best mode for carrying out the present invention;

Fig. 5A is a block diagram illustrating a construction of the touch pad according to a second best mode for carrying out the present invention;

Fig. 5B is a flow chart illustrating an operation of the touch pad according to the second best mode for carrying out the present invention;

Fig. 6 is a block diagram illustrating a construction of the touch pad according to a third best mode for carrying out the present invention;

Fig. 7 is a block diagram illustrating a construction of the touch pad according to a fourth best mode for carrying out the present invention;

Fig. 8 is a perspective view of an LCD illustrating positions of fingers in touch therewith according to the third and the fourth best modes for carrying out the present invention; and

Fig. 9 is a perspective view of the LCD illustrating a hot key button thereof according to the third and the fourth best modes to carry out the present invention.

Best Modes for Carrying out the Invention

First Best Mode(Figs. 4A and 4B)

The first best mode is a method of realizing a fingerprint recognition mode and a touch pad mode by means of a TFT type fingerprint reader alone. Fig. 4A shows the corresponding construction. As described above, the present invention relates to a computer input apparatus such as a notebook computer, which can be controlled by a CPU of the computer. The fingerprint recognizing touch pad according to the first best mode comprises: a TFT type fingerprint reader 10 including a sensor TFT 12 and a switching TFT 13; a backlight 20 positioned beneath the fingerprint reader 10 for illuminating a light by penetrating the fingerprint reader 10; a gate control section 22 applied to a gate terminal 13-G of the switching TFT 13 within the fingerprint reader 10 for generating a gate signal to control switching timing; a signal output section 24 for amplifying signals of a

fingerprint image sensed by the sensor TFT 12 and outputted by the switching TFT 13 of the fingerprint reader 10, multiplexing the amplified signals, and outputting the multiplexed signals as a single image signal; a backlight control section 26 for adjusting an amount of light emitted from the backlight 20, and controlling on/off of the backlight 20; and a mode control section 28 for realizing a fingerprint recognition mode or a touch pad mode by controlling the gate control section 22 and the backlight control section 26.

The mode control section 28 controls the gate control section 22 and the backlight control section 26 in accordance with the fingerprint recognition mode and the touch pad mode under a command by a CPU of a computer. To be specific, upon receipt of a command for fingerprint recognition from the CPU, the mode control section 28 controls the gate control section 22 and the backlight control section 26 so as to conform to the fingerprint recognition mode. Upon receipt of a command for touch pad from the CPU, the mode control section 28 controls the gate control section 22 and the backlight control section 26 so as to conform to the touch pad mode.

In a fingerprint recognition mode, the fingerprint image of a finger in touch with the fingerprint reader 10 is precisely scanned and inputted to the CPU through the signal output section 24, and the CPU reads the image signal to authenticate an access. This process is the same as an operation of the conventional fingerprint recognition system. In a touch pad mode on the other hand, the image signal of a finger in touch with the fingerprint reader 10 is inputted through the signal output section 24, and the CPU processes the image signal and determine positions of the fingers and to input keys as done by a conventional mouse or a trackball.

More specific description of the operational mechanism will be made herein below with reference to Fig. 4B illustrating a method for controlling the touch pad according to

the first best mode for carrying out the present invention.

For a fingerprint recognition mode, the CPU of the computer commands the mode control section 28 to realize the fingerprint recognition mode [S100]. This case is pertinent to an occasion of first empowering or re-booting the computer.

The mode control section 28, which has received the command for fingerprint recognition, controls the gate control section 22 and the backlight control section 26 so as to conform to the fingerprint recognition mode. In other words, an accurate recognition of the fingerprint can be executed when the switching TFT of the fingerprint reader is switched at high velocity and the sensor TFT scans the fingerprint image at high resolution. Therefore, the gate control section 22 is controlled so as to generate a gate control signal of high frequency [S102].

The backlight control section controls the backlight to emit a bright light [S104]. A flat emitting LED or an electroluminescent lamp (EL) device may be used for the backlight. The luminosity can be varied by simply varying an applied voltage.

If a user touches a fingerprint window with his/her finger under a state set to be suitable for recognition of a fingerprint, the fingerprint is scanned and a fingerprint image signal is outputted by the signal output section 24 according to the operational mechanism as described with reference to Figs. 2A and 2B [S106]. The CPU subsequently processes the signal, reads the fingerprint image, and compares the read image with a pre-registered fingerprint image [S108]. If the compared images discord with each other, scanning and recognizing steps of the fingerprint image are performed once again [S110]. If the compared images accord with each other, authentication of an access is performed [S112], and a touch pad mode is realized [S114].

Upon receipt of the command for realizing a touch pad mode, the mode control

section 28 controls the gate control section 22 and the backlight control section 26 to conform to the touch pad mode. This means that, the mode control section 28 controls the gate control section 22 to generate a gate control signal of low frequency and scan the fingerprint image at low resolution because, even if the switching TFT of the fingerprint reader is switched at low velocity, the position of the finger can be located without difficulty.

Meanwhile, the backlight control section 26 controls the backlight to lower the luminosity thereof [S118]. As only a positional image of the finger is required in the touch pad mode irrespective of the fingerprint image, the luminosity of the backlight may be lowered without any problem. Lowering the luminosity of the backlight serves to save electric power.

Under the environment set suitable for operation of the touch pad, the user may use the fingerprint reader as a touch pad [S120]. This means that, if the user touches the fingerprint window with his/her finger, a fingerprint image is outputted by the signal output section 24 under the mechanism as described with reference to Fig. 3A. The CPU processes the signal to determine positions of the fingers.

The user needs to enter or click by moving his/her finger to execute a desired function. A novel method was adopted in the first best mode to execute the clicking function. The pressure sensor is loaded on a lower layer in the conventional touch pad. Therefore, clicking is performed if the user pushes the touch pad with his/her finger at a predetermined pressure while moving the finger. However, according to the first best mode for carrying out the present invention, a touch pad function is executed by means of the fingerprint reader alone without the pressure sensor. Therefore, a separate method is required to execute the clicking function.

One of the available methods is a method of recognizing the clicking by two fingers touched on the touch pad [S124]. To be specific, according to the projectively converting method as shown in Fig. 3B, two pulses 18 18', 19 19' appear on both or either one of the X-axis and the Y-axis if two fingers simultaneously touch the fingerprint reader. The CPU recognizes this fact to determine that the user clicked at the previous position.

Another available method is a method of recognizing a clicking if a finger touches the fingerprint reader 10 twice, as in case of the conventional touch pad. Though not shown in the drawing, this method can replace the step 122 in Fig. 4B. A clicking is recognized if a finger taps the finger touch window twice while moving on a surface of the fingerprint reader under a touched state. Referring to Fig. 3C, tapping the finger touch window twice with a finger means an attachment to (A), a detachment from (B), a second attachment to (C), a second detachment from (D), and a third attachment to (E) the finger touch window with a finger. Different data are outputted under the attached state and the detached state of the finger, and the CPU can sense the clicking as in case of recognizing the pulse waveform shown in Fig. 3C.

While using the touch pad, the CPU counts the time. If the finger does not move or take any actions on the touch pad for a predetermined period of time [S126], the touch pad function is suspended [S128] by switching off the backlight 20. This is to prevent unnecessary consumption of electric power and unnecessary operation of the CPU or the gate control section 22.

When the suspended touch pad function is to be restored, any one of the keys on a keyboard may be pushed [S130] so that the CPU can recognize it as a touch pad restoration function. Then, the backlight control section 26 operates again to illuminate the backlight and make the touch pad function available.

According to the present invention, no separate touch pad is required in addition to the fingerprint reader, and spatial limit is released on a notebook or a keyboard. As a consequence, the size of the finger touch window of the fingerprint reader (touch pad) can be expanded according to the present invention in comparison with the conventional one. Therefore, the finger touch window can simultaneously accommodate touches by two or three fingers. Since the CPU can authenticate an access after recognizing a plurality of fingerprints on a simultaneous basis and comparing the fingerprints with a pre-registered fingerprint, security is enhanced than the case of authenticating an access based on a single fingerprint.

Second Best Mode (Figs. 5A and 5B)

The second best mode is a method of realizing the fingerprint recognition mode and the touch pad mode by means of a TFT type fingerprint reader and a pressure sensor. Fig. 5A illustrates a corresponding construction. The fingerprint recognizing touch pad system according to the second best mode for carrying out the present invention comprises: a TFT type fingerprint reader 10 including a sensor TFT 12 and a switching TFT 13; a backlight 20 positioned beneath the fingerprint reader 10 for illuminating a light by penetrating the fingerprint reader 10; a pressure sensor 30 positioned beneath the backlight 20 for responding to the pressure loaded on the fingerprint reader 10; a gate control section 22 applied to a gate terminal 13-G of the switching TFT 13 in the fingerprint reader 10 for generating a gate signal for controlling a switching timing; a signal output section 24 for amplifying fingerprint image signals outputted by the switching TFT 13 sensed by the sensor TFT 12 of the fingerprint reader 10, multiplexing the amplified signals, and outputting the multiplexed signals as a single image signal; a backlight control section 26 for adjusting an amount of light emitted from the backlight 20, and controlling on/off of the

backlight 20; and a mode control section 28 for realizing a fingerprint recognition mode or a touch pad mode by controlling the gate control section 22 and the backlight control section 26.

All the constitutional elements are the same as in the case of the first best mode except the pressure sensor 30. Hence, no detailed description will be made herein. The pressure sensor 30 is to execute an entering or a clicking function by touching and pushing the finger touch window with a finger of the user, as in the case of the conventional touch pad.

To be specific, if the user pushes the touch pad window (the finger touch window of the fingerprint reader) with his/her finger at a predetermined pressure while moving the finger, the pressure is transferred to the pressure sensor 30 through the fingerprint reader 10 and the backlight 20. Therefore, the pressure sensor 30 outputs an electric signal that is sensed by the CPU to recognize a clicking by the user.

The fingerprint reader 10 according to the present invention has a very slim structure *per se*. The backlight 20 also has a thickness of a few millimeters if an EL device is employed. Thus, the pressure sensor 30 can sufficiently operate under the pressure loaded on the fingerprint reader 10.

All the steps are the same as the case of the first best mode except the step of processing a click signal by means of the pressure sensor 30. In other words, clicking can be performed [S124'] by recognizing an output of a pressure sensing signal [S122'] from the pressure sensor 30 instead of taking the step of recognizing a plurality of fingers in Fig. 4B [S122].

Third Best Mode (Fig. 6)

The third best mode is a method of realizing the fingerprint recognition mode and

the touch pad mode by means of a TFT type fingerprint reader and an LCD display. The fingerprint recognizing touch pad system according to the third best mode for carrying out the present invention comprises: a TFT type fingerprint reader 10 including a sensor TFT 12 and the switching TFT 13 as shown in Fig. 2A; an LCD display 32 positioned beneath the fingerprint reader 10 for displaying diverse characters and messages; a backlight 20 for illuminating a light upward by penetrating the fingerprint reader 1 and the LCD display 32; a gate control section 22 applied to a gate terminal 13-G of the switching TFT 13 within the fingerprint reader 10 for controlling a switching timing; a signal output section 24 for amplifying fingerprint image signals outputted by the switching TFT 13 sensed by the sensor TFT 12 of the fingerprint reader 10, multiplexing the amplified signals, and outputting the multiplexed signals as a single image signal; an LCD driving section 34 for receiving a character display signal from a CPU so that the LCD display 32 can display predetermined characters; a backlight control section 26 for adjusting an amount of light emitted from the backlight 20, and controlling on/off of the backlight 20; and a mode control section 28 for realizing a fingerprint recognition mode or a touch pad mode by controlling the gate control section 22 and the backlight control section 26.

The mode control section 28 controls the gate control section 22 and the backlight control section 26 in accordance with the fingerprint recognition mode and the touch pad mode under a command by a CPU of a computer. To be specific, upon receipt of a command for fingerprint recognition from the CPU, the mode control section 28 controls the gate control section 22 and the backlight control section 26 so as to conform to the fingerprint recognition mode. Upon receipt of a command for touch pad from the CPU, the mode control section 28 controls the gate control section 22 and the backlight control section 26 so as to conform to the touch pad mode.

In a fingerprint recognition mode, the fingerprint image of a finger in touch with the fingerprint reader 10 is precisely scanned and inputted to the CPU through the signal output section 24, and the CPU reads the image signal to authenticate an access. This process is the same as an operation of the conventional fingerprint recognition system. In a touch pad mode on the other hand, the image signal of a finger in touch with the fingerprint reader 10 is inputted through the signal output section 24, and the CPU processes the image signal and determines positions of the fingers and to input keys as done by a conventional mouse or a trackball.

The operation of the fingerprint recognition mode and the touch pad mode according to the third best mode for carrying out the present invention is the same as shown in the flowchart of Fig. 4B illustrating a controlling method. However, more space can be saved according to the third best mode than installing a separate display because the LCD display 32 can display character messages beneath the fingerprint reader 10.

This means that, a variety of messages can be displayed such as "[T]ouch the finger touch window of the fingerprint reader with a finger because the current mode is a fingerprint recognition mode" or "[T]he mode has been shifted to a touch pad mode". Also, positions of fingers can be displayed for precise scanning of the fingerprint. Especially when reading all the fingerprints of two or three fingers as described above, the positions (36) of the fingers can be displayed so that the fingers may touch the predetermined positions as shown in Fig. 8.

Since the LCD display 32 has been installed together with the fingerprint reader 10, a hot key function can be executed by combining the touch pad mode with the LCD display 32. To be specific, a necessary hot key button 38 is displayed on the LCD display 32 instead of a monitor screen as shown in Fig. 9, and a desired hot key is selected by using

the fingerprint reader as a touch pad mode to execute a hot key function. The hot key function can also be executed by pushing any one of a key on a keyboard and touching a hot key button, or by magnifying the size of the hot key button and by simultaneously touching the fingerprint reader with two fingers. The CPU then recognizes the clicking as shown in Fig. 3B.

The remaining operation of the third best mode is the same as in the case of the first best mode except the LCD display 32.

Fourth Best Mode (Fig. 7)

The fourth best mode is a method of realizing the fingerprint recognition mode and the touch pad mode by means of a TFT type fingerprint reader, an LCD display and a pressure sensor. Fig. 7 shows the corresponding construction. The fingerprint recognizing touch pad system according to the fourth best mode for carrying out the present invention comprises: a TFT type fingerprint reader 10 including a sensor TFT 12 and the switching TFT 13 as shown in Fig. 2A; an LCD display 32 positioned beneath the fingerprint reader 10 for displaying diverse characters and messages; a backlight 20 for illuminating a light upward by penetrating the fingerprint reader 1 and the LCD display 32; a pressure sensor 30 positioned beneath the backlight 20 for responding to the pressure loaded on the fingerprint reader 10; a gate control section 22 applied to a gate terminal 13-G of the switching TFT 13 within the fingerprint reader 10 for controlling a switching timing; a signal output section 24 for amplifying fingerprint image signals outputted by the switching TFT 13 sensed by the sensor TFT 12 of the fingerprint reader 10, multiplexing the amplified signals, and outputting the multiplexed signals as a single image signal; an LCD driving section 34 for receiving a character display signal from a CPU so that the LCD display 32 can display predetermined characters; a backlight control section 26 for

adjusting an amount of light emitted from the backlight 20, and controlling on/off of the backlight 20; a backlight control section 26 for adjusting an amount of light emitted from the backlight 20, and controlling on/off of the backlight 20; and a mode control section 28 for realizing a fingerprint recognition mode or a touch pad mode by controlling the gate control section 22 and the backlight control section 26.

All the constitutional elements are the same as in the case of the first best mode except the pressure sensor 30. Hence, no detailed description will be made herein. The pressure sensor 30 is to execute an entering or a clicking function by touching and pushing the finger touch window with a finger of the user, as in the case of the conventional touch pad.

The remaining operation of the fourth best mode is the same as in the case of the third best mode except the pressure sensor 30. This means that, a variety of messages can be displayed such as "[T]ouch the finger touch window of the fingerprint reader with a finger because the current mode is a fingerprint recognition mode" or "[T]he mode has been shifted to a touch pad mode". Also, when reading all the fingerprints of two or three fingers as described above, the positions of fingers can be displayed so that the fingers may touch the predetermined positions. A hot key function may also be executed by combining the touch pad mode with the LCD display 32.

As described above, the touch pad function can be executed by using the structure of the conventional TFT type fingerprint reader according to the present invention. As a consequence, the size of the finger touch window of the fingerprint reader can be expanded according to the present invention in comparison with the conventional one such as a notebook, which requires a fingerprint reader, a touch pad, and an LCD display on a separate basis. The unit cost is reduced and the control circuit is simplified as a result.

Further, since the CPU can authenticate an access after recognizing a plurality of fingerprints on a simultaneous basis and comparing the fingerprints with a pre-registered fingerprint, security is enhanced than the case of authenticating an access based on a single fingerprint. Moreover, an entry or a clicking function can be executed without a pressure sensor unlike the conventional touch pad, and the touch pad can operate with a pen as well as with a finger. Guiding messages or a fingerprint position lines can also be displayed through combination with the LCD display, and a hot key button can be displayed on a LCD window to enhance a user convenience.

While the invention has been shown and described with reference to certain best modes thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What Is Claimed Is:

1. A method of implementing a touch pad by using a fingerprint reader, characterized by realizing a fingerprint recognition mode and a touch pad mode by means of a TFT type fingerprint reader (hereinafter, referred to as "a fingerprint reader") structured to have a plurality of unit cells arrayed therein to include a sensor TFT and a switching TFT in each unit cell for scanning fingerprints image, and a backlight positioned beneath the fingerprint reader for illuminating a light so as to penetrate the fingerprint reader, the method comprising the steps of:

scanning fingerprints by means of an original function of the fingerprint reader to recognize the fingerprints in the fingerprint recognition mode; and

locating positions of the fingers by projectively converting output values of each unit cell for the position of the finger with respect to an X-axis and a Y-axis in the touch pad mode.

2. A method of implementing a touch pad by using a fingerprint reader, characterized by realizing a fingerprint recognition mode and a touch pad mode by means of a TFT type fingerprint reader (hereinafter, referred to as "a fingerprint reader") structured to have a plurality of unit cells arrayed therein to include a sensor TFT and a switching TFT in each unit cell for scanning fingerprints image, a backlight positioned beneath the fingerprint reader for illuminating a light so as to penetrate the fingerprint reader, and a pressure sensor positioned beneath the backlight for outputting an electric signal by sensing a pressure loaded on the fingerprint reader, the method comprising the steps of:

scanning fingerprints by means of an original function of the fingerprint reader to recognize the fingerprints in a fingerprint recognition mode; and

locating positions of the fingers by projectively converting output values of each unit cell for the position of the finger with respect to an X-axis and a Y-axis in a touch pad mode.

3. A method of implementing a touch pad by using a fingerprint reader, characterized by realizing a fingerprint recognition mode and a touch pad mode by means of a TFT type fingerprint reader (hereinafter, referred to as "a fingerprint reader") structured to have a plurality of unit cells arrayed therein to include a sensor TFT and a switching TFT in each unit cell for scanning fingerprints image, an LCD display positioned beneath the fingerprint reader to display characters or messages, and a backlight positioned beneath the LCD display for illuminating a light so as to penetrate the LCD display and the fingerprint reader, the method comprising the steps of:

scanning fingerprints by means of an original function of the fingerprint reader to recognize the fingerprints in a fingerprint recognition mode;

locating positions of the fingers by projectively converting output values of each unit cell for the position of the finger with respect to an X-axis and a Y-axis in a touch pad mode; and

displaying a guiding message by means of the LCD display in the fingerprint recognition mode and the touch pad mode.

4. A method of implementing a touch pad by using a fingerprint reader, characterized by realizing a fingerprint recognition mode and a touch pad mode by means of a TFT type fingerprint reader (hereinafter, referred to as "a fingerprint reader") structured to have a plurality of unit cells arrayed therein to include a sensor TFT and a switching TFT in each unit cell for scanning fingerprints image, an LCD display positioned beneath the fingerprint reader to display characters or messages, a backlight positioned

beneath the LCD display for illuminating a light so as to penetrate the LCD display and the fingerprint reader, and a pressure sensor for outputting an electric signal by sensing a pressure loaded on the fingerprint reader, the method comprising the steps of:

scanning fingerprints by means of an original function of the fingerprint reader to recognize the fingerprints in a fingerprint recognition mode;

locating positions of the fingers by projectively converting output values of each unit cell for the position of the finger with respect to an X-axis and a Y-axis in a touch pad mode; and

displaying a guiding message by means of the LCD display in the fingerprint recognition mode and the touch pad mode.

5. The method of claim 1 or 3, wherein the clicking function in the touch pad mode is executed by recognizing a touch of the fingerprint reader with two fingers.

6. The method of claim 1 or 3, wherein the clicking function in the touch pad mode is executed by tapping the fingerprint reader twice with the finger.

7. The method of claim 2 or 4, wherein the clicking function in the touch pad mode is executed by sensing a pressure loaded on the fingerprint reader with the pressure sensor.

8. The method of any one of claims 1 to 4, wherein the fingerprint image is scanned at high resolution in the fingerprint recognition mode, and the position of the finger is scanned at low resolution in the touch pad mode.

9. The method of any one of claims 1 to 4, wherein luminosity of the backlight is heightened in the fingerprint recognition mode and lowered in the touch pad mode.

10. The method of any one of claims 1 to 4, wherein the backlight is switched

off when the touch pad is not used for a predetermined period of time in the touch pad mode, and the original state is restored when any one of the keys on a keyboard is pushed.

11. The method of any one of claims 1 to 4, wherein a plurality of fingerprints are recognized in the fingerprint recognition mode.

12. The method of claim 3 or 4, wherein the LCD display displays positions of the fingers, a fingerprint of which is to be inputted.

13. The method of claim 3 or 4, wherein the LCD display displays a hot key button for directly executing a predetermined function.

14. A touch pad apparatus for fingerprint reading, characterized by an input apparatus of a computer including a notebook computer to read a fingerprint under control by a CPU of a computer, the apparatus comprising:

a TFT type fingerprint reader consisting of a sensor TFT and a switching TFT;

a backlight positioned beneath the fingerprint reader for illuminating a light upward so as to penetrate the fingerprint reader;

a gate control section applied to a gate terminal of the switching TFT in the fingerprint reader for generating a gate signal to control a switching timing;

a signal output section for amplifying signals of a fingerprint image sensed by the sensor TFT of the fingerprint reader and outputted by the switching TFT, multiplexing the amplified signals, and outputting the multiplexed signals as a single image signal;

a backlight control section for adjusting an amount of light emitted from the backlight, and controlling on/off of the backlight; and

a mode control section for realizing a fingerprint recognition mode or a touch pad mode by controlling the gate control section and the backlight control section,

wherein the mode control section heightens resolution of the gate signal and

luminosity of the backlight in the fingerprint recognition mode, lowers resolution of the gate signal and luminosity of the backlight in the touch pad mode, and switches off the backlight when the touch pad is not used for a predetermined period of time.

15. A touch pad apparatus for fingerprint reading, characterized by an input apparatus of a computer including a notebook computer to read a fingerprint under control by a CPU of a computer, the apparatus comprising:

a TFT type fingerprint reader consisting of a sensor TFT and a switching TFT;

a backlight positioned beneath the fingerprint reader for illuminating a light upward so as to penetrate the fingerprint reader;

a pressure sensor positioned beneath the backlight for responding to a pressure loaded on the fingerprint reader;

a gate control section applied to a gate terminal of the switching TFT in the fingerprint reader for generating a gate signal to control a switching timing;

a signal output section for amplifying signals of a fingerprint image sensed by the sensor TFT of the fingerprint reader and outputted by the switching TFT, multiplexing the amplified signals, and outputting the multiplexed signals as a single image signal;

a backlight control section for adjusting an amount of light emitted from the backlight, and controlling on/off of the backlight; and

a mode control section for realizing a fingerprint recognition mode or a touch pad mode by controlling the gate control section and the backlight control section,

wherein the mode control section heightens resolution of the gate signal and luminosity of the backlight in the fingerprint recognition mode, lowers resolution of the gate signal and luminosity of the backlight in the touch pad mode, and switches off the backlight when the touch pad is not used for a predetermined period of time.

16. A touch pad apparatus for fingerprint reading, characterized by an input apparatus of a computer including a notebook computer to read a fingerprint under control by a CPU of a computer, the apparatus comprising:

a TFT type fingerprint reader consisting of a sensor TFT and a switching TFT;

an LCD display positioned beneath the fingerprint reader for displaying a variety of characters and messages;

a backlight positioned beneath the fingerprint reader for illuminating a light upward so as to penetrate the fingerprint reader;

a gate control section applied to a gate terminal of the switching TFT in the fingerprint reader for generating a gate signal to control a switching timing;

a signal output section for amplifying signals of a fingerprint image sensed by the sensor TFT of the fingerprint reader and outputted by the switching TFT, multiplexing the amplified signals, and outputting the multiplexed signals as a single image signal;

an LCD driving section for displaying predetermined characters on the LCD display by receiving a character display signal from the CPU;

a backlight control section for adjusting an amount of light emitted from the backlight, and controlling on/off of the backlight; and

a mode control section for realizing a fingerprint recognition mode or a touch pad mode by controlling the gate control section and the backlight control section,

wherein the mode control section heightens resolution of the gate signal and luminosity of the backlight in the fingerprint recognition mode, lowers resolution of the gate signal and luminosity of the backlight in the touch pad mode, and switches off the backlight when the touch pad is not used for a predetermined period of time.

17. A touch pad apparatus for fingerprint reading, characterized by an input

apparatus of a computer including a notebook computer to read a fingerprint under control by a CPU of a computer, the apparatus comprising:

a TFT type fingerprint reader consisting of a sensor TFT and a switching TFT;

an LCD display positioned beneath the fingerprint reader for displaying a variety of characters and messages;

a backlight positioned beneath the LCD display for illuminating a light upward so as to penetrate the fingerprint reader;

a pressure sensor positioned beneath the backlight for responding to a pressure loaded on the fingerprint reader;

a gate control section applied to a gate terminal of the switching TFT in the fingerprint reader for generating a gate signal to control a switching timing;

a signal output section for amplifying signals of a fingerprint image sensed by the sensor TFT of the fingerprint reader and outputted by the switching TFT, multiplexing the amplified signals, and outputting the multiplexed signals as a single image signal;

an LCD driving section for displaying predetermined characters on the LCD display by receiving a character display signal from the CPU;

a backlight control section for adjusting an amount of light emitted from the backlight, and controlling on/off of the backlight; and

a mode control section for realizing a fingerprint recognition mode or a touch pad mode by controlling the gate control section and the backlight control section,

wherein the mode control section heightens resolution of the gate signal and luminosity of the backlight in the fingerprint recognition mode, lowers resolution of the gate signal and luminosity of the backlight in the touch pad mode, and switches off the backlight when the touch pad is not used for a predetermined period of time.

18. The touch pad apparatus of claim 15 or 17, wherein a clicking function in the touch pad mode is executed by the CPU's recognition of a touch of the fingerprint reader with two fingers.

19. The touch pad apparatus of claim 15 or 17, wherein a clicking function in the touch pad mode is executed by the CPU's recognition of a tapping of the fingerprint twice with a finger.

20. The touch pad apparatus of claim 16 or 18, wherein a clicking function in the touch pad mode is executed by the CPU's sensing of an output signal from the pressure sensor in accordance with a pressure generated when a finger pushes the fingerprint reader.

Fig. 1

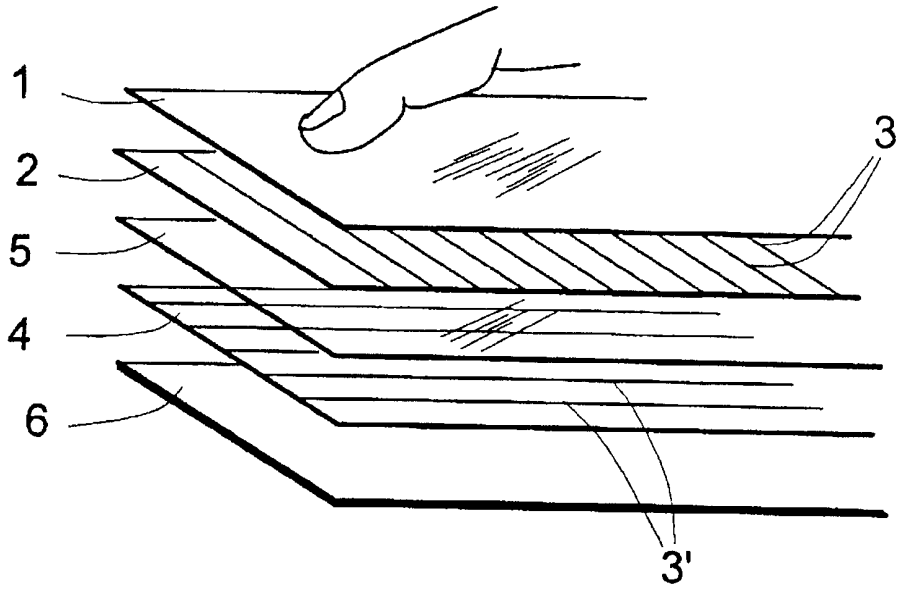


Fig. 2A

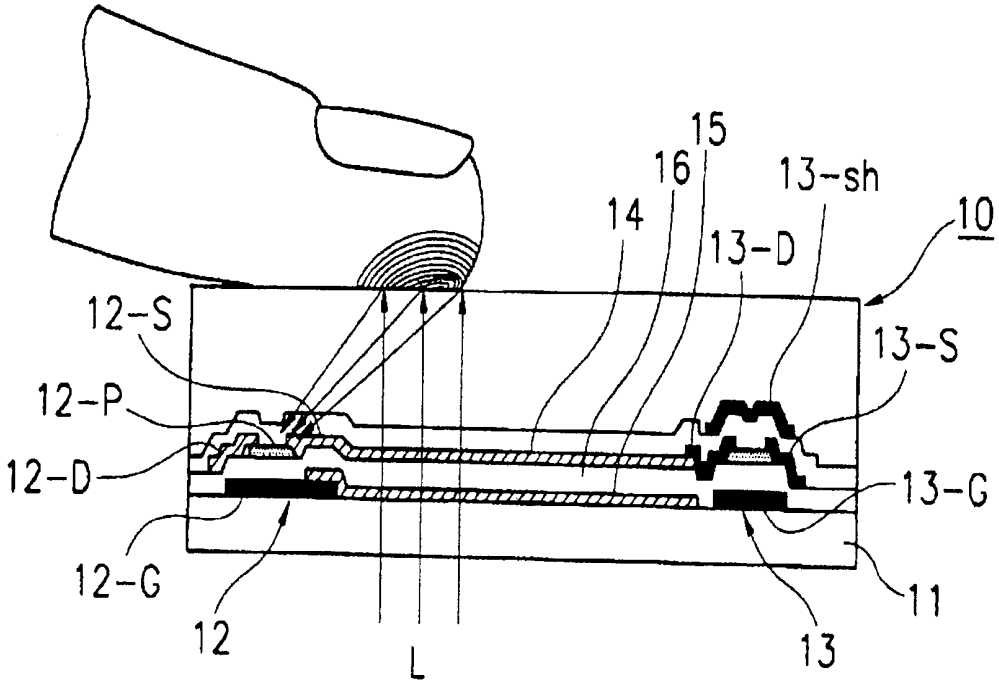


Fig. 2B

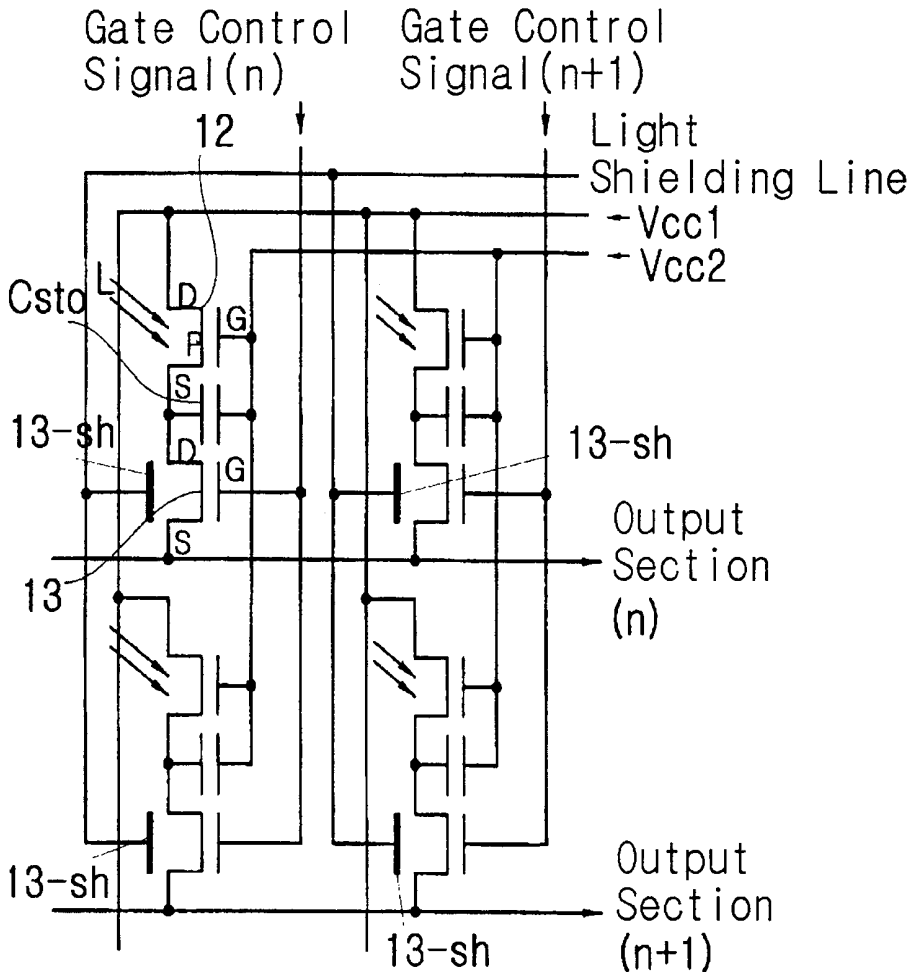

Gate Control Signal(n)
Gate Control Signal(n+1)
12
Light Shielding Line
Vcc1
Vcc2
Csto
L
D
G
P
S
13-sh
D
G
S
13
13-sh
Output Section (n)
13-sh
13-sh
Output Section (n+1)

Fig. 3A

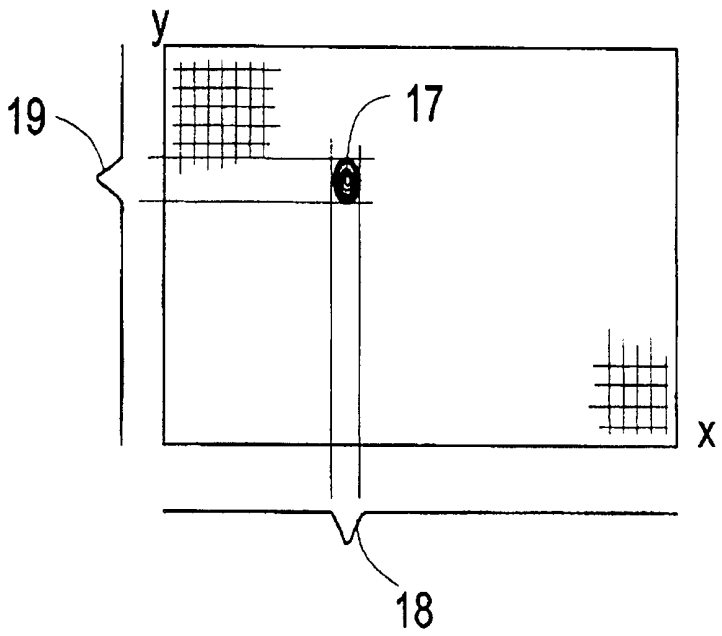


Fig. 3B

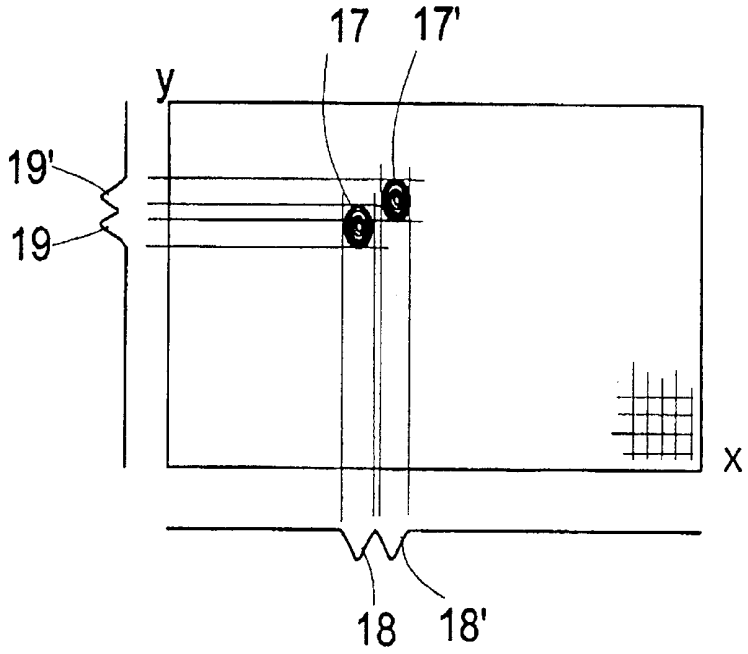


Fig. 3C

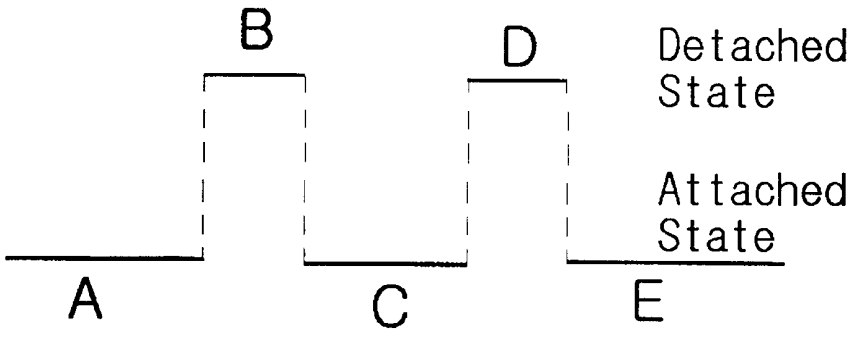


Fig. 4A

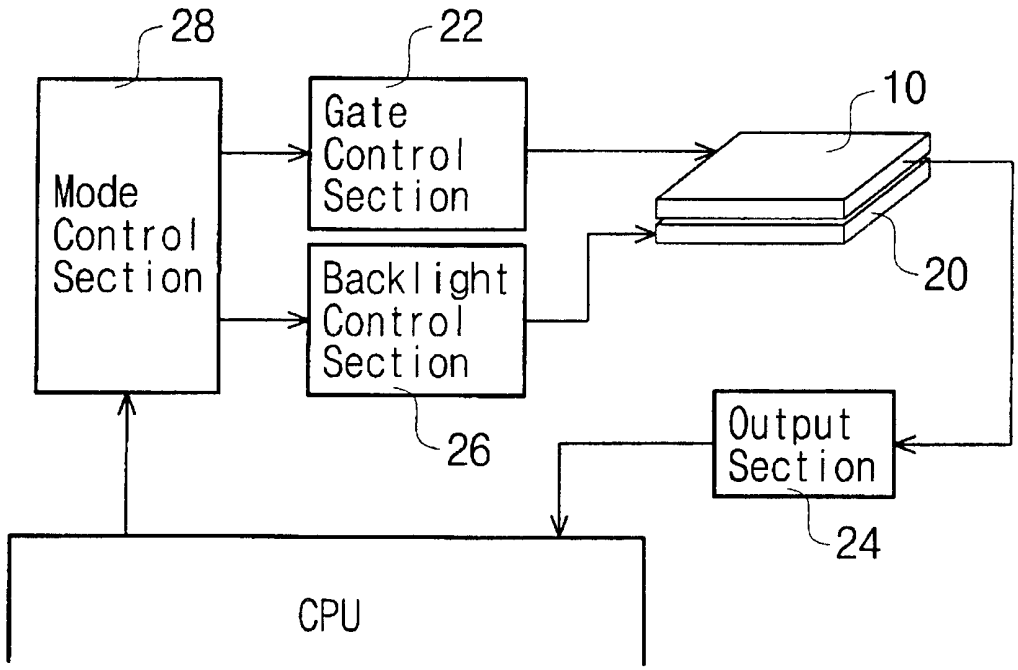

28
22
10
Mode Control Section
Gate Control Section
Backlight Control Section
20
26
Output Section
24
CPU

Fig. 4B

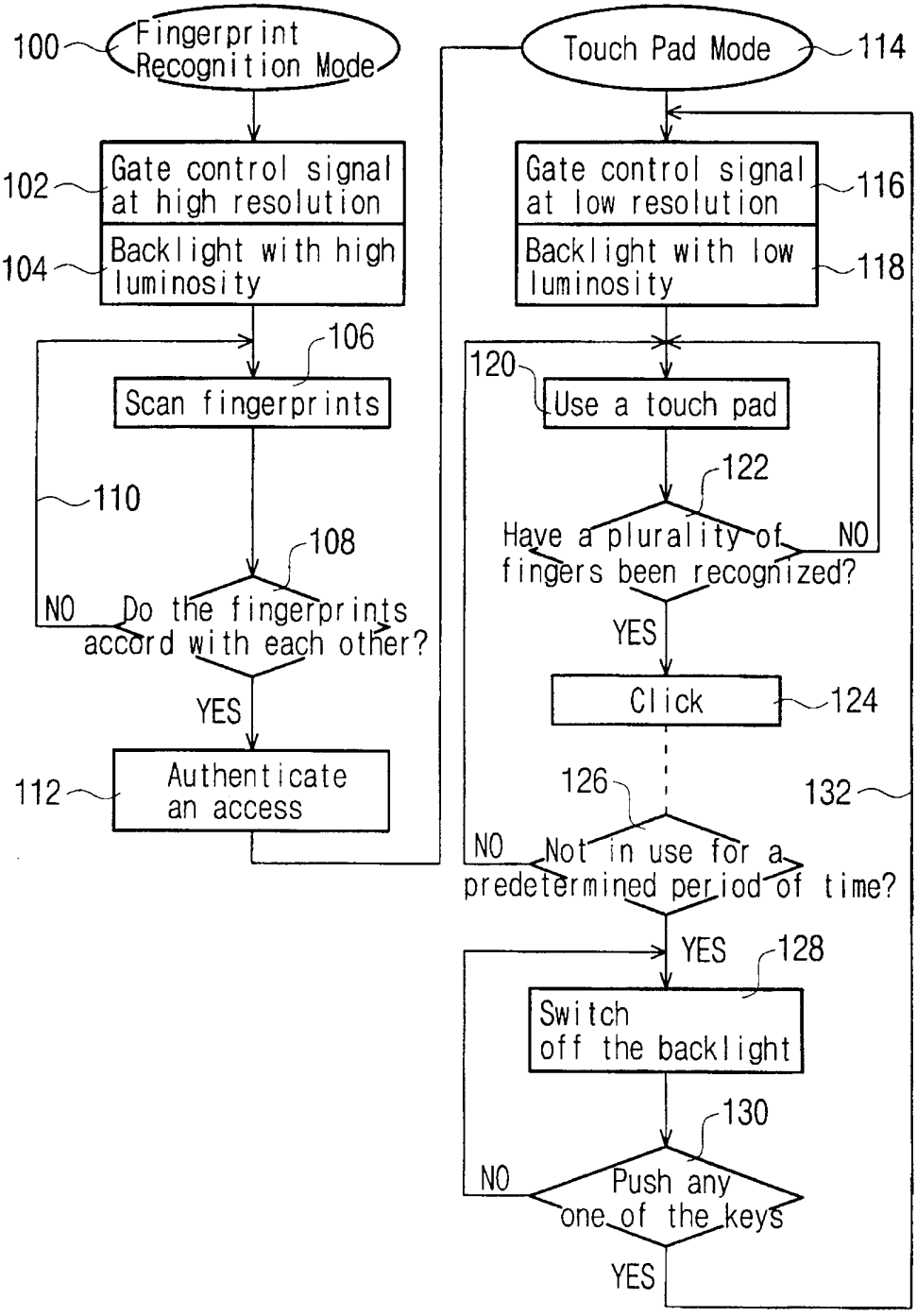

100
Fingerprint Recognition Mode
102
Gate control signal at high resolution
104
Backlight with high luminosity
106
Scan fingerprints
110
108
NO
Do the fingerprints accord with each other?
YES
112
Authenticate an access
Touch Pad Mode
114
Gate control signal at low resolution
116
Backlight with low luminosity
118
120
Use a touch pad
122
Have a plurality of fingers been recognized?
NO
YES
Click
124
126
132
NO
Not in use for a predetermined period of time?
YES
128
Switch off the backlight
130
NO
Push any one of the keys
YES

Fig. 5A

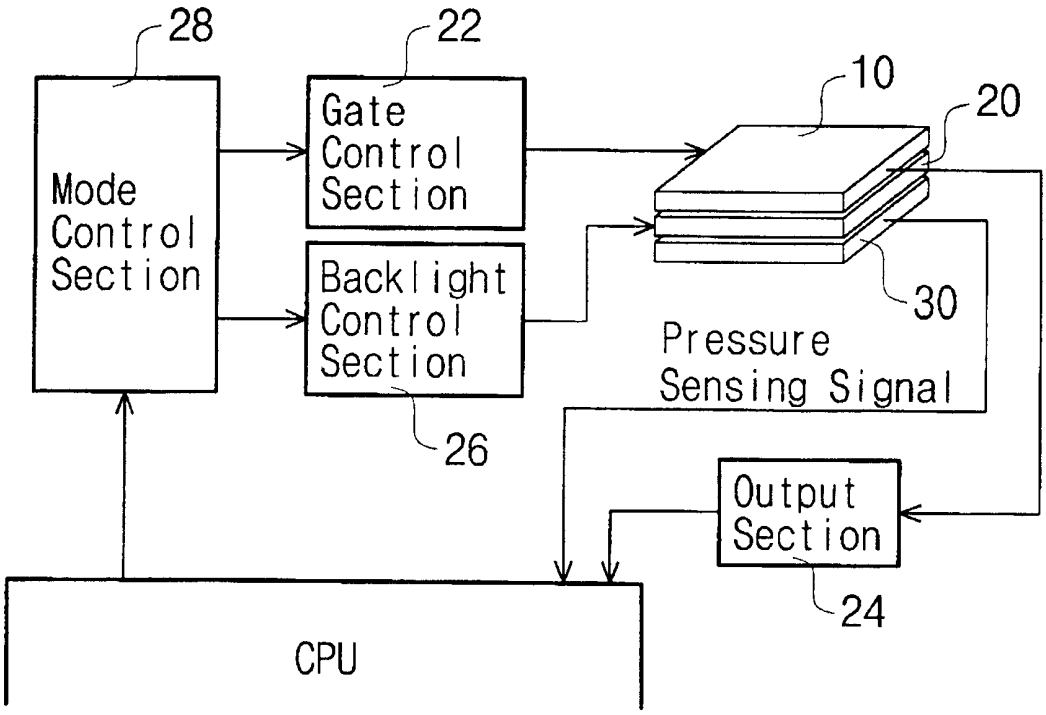

28
22
10
20
Mode Control Section
Gate Control Section
Backlight Control Section
26
30
Pressure Sensing Signal
Output Section
24
CPU

Fig. 5B

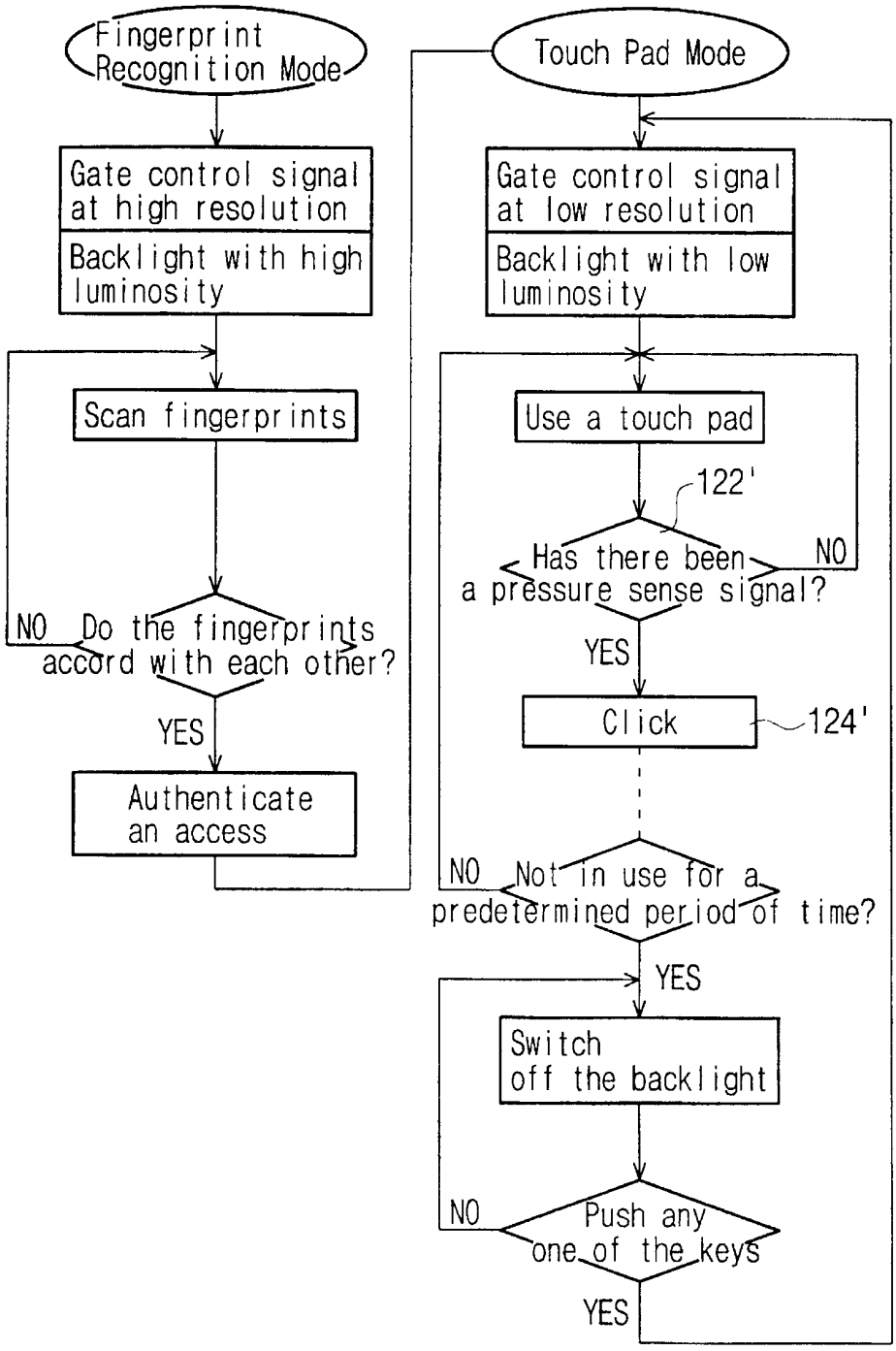

Fingerprint Recognition Mode
Gate control signal at high resolution
Backlight with high luminosity
Scan fingerprints
NO
Do the fingerprints accord with each other?
YES
Authenticate an access
Touch Pad Mode
Gate control signal at low resolution
Backlight with low luminosity
Use a touch pad
122'
Has there been a pressure sense signal?
NO
YES
Click
124'
NO
Not in use for a predetermined period of time?
YES
Switch off the backlight
NO
Push any one of the keys
YES

Fig. 6

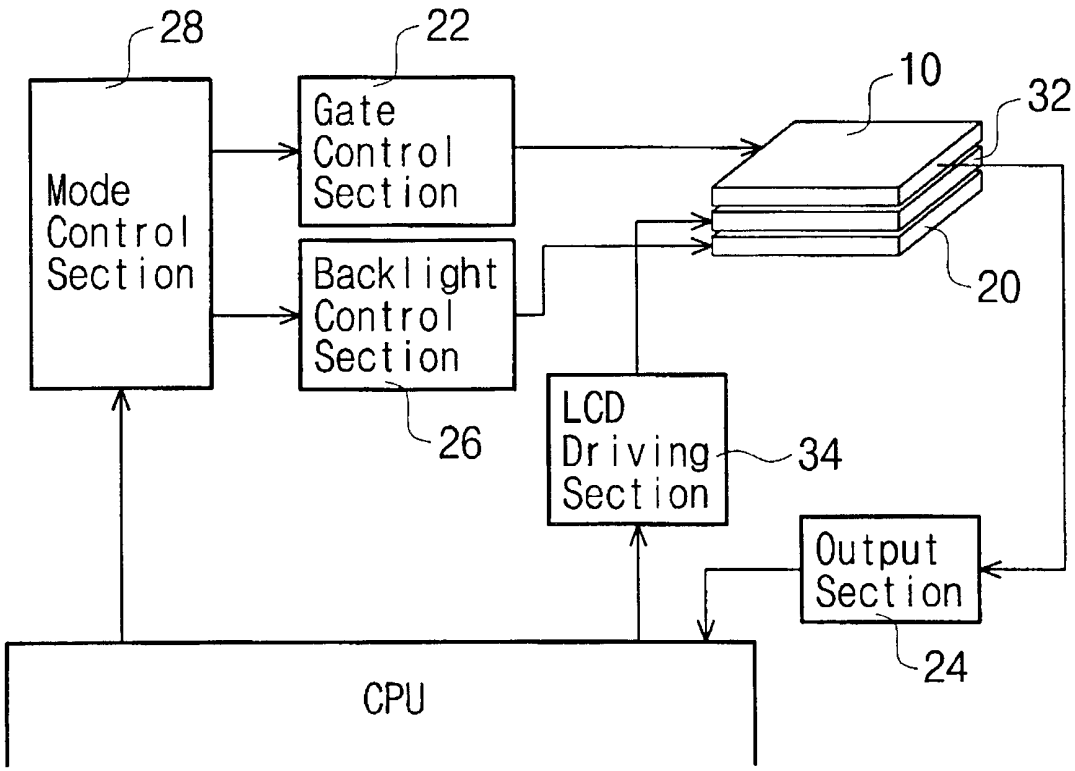

28
22
10
32
Mode Control Section
Gate Control Section
Backlight Control Section
20
26
LCD Driving Section
34
Output Section
24
CPU

Fig. 7

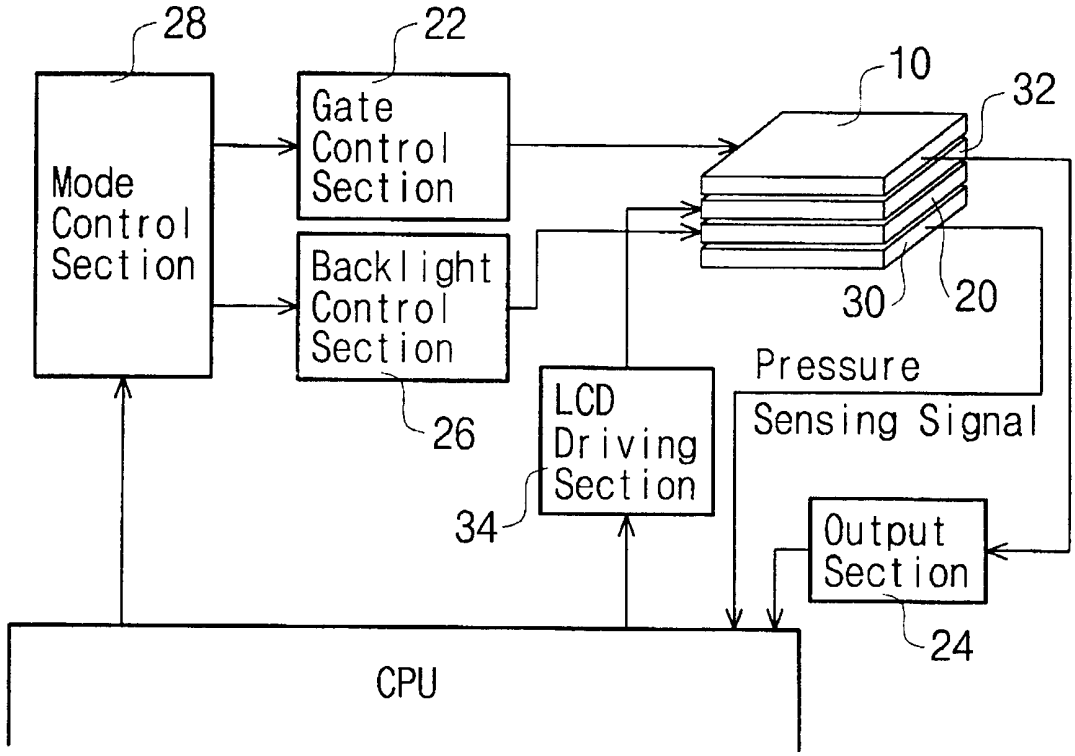

28
22
10
32
Mode Control Section
Gate Control Section
Backlight Control Section
26
30
20
Pressure Sensing Signal
LCD Driving Section
34
Output Section
24
CPU

Fig. 8

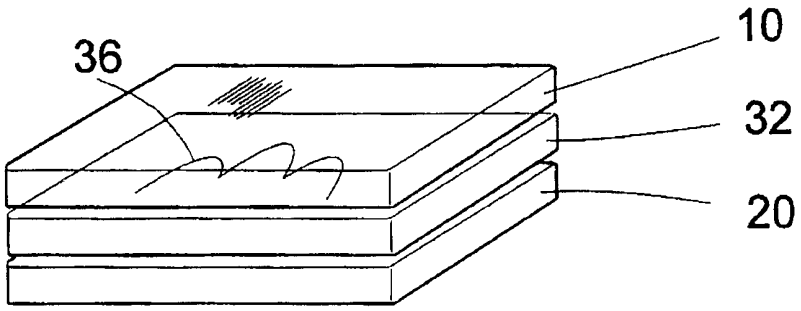
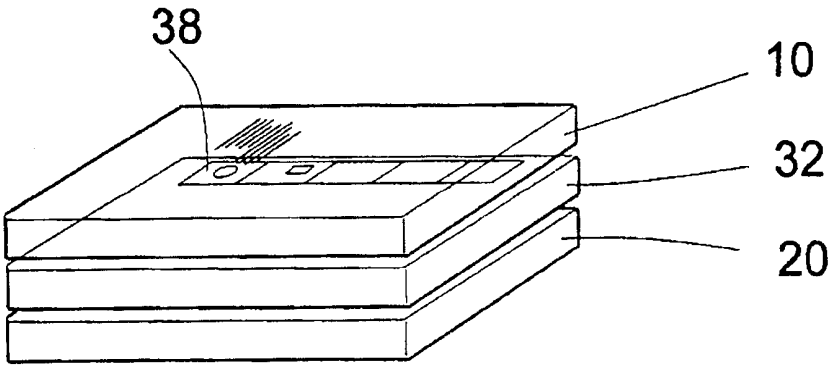


Fig. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR01/00194

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G06F 3/033

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

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)
IPC7 G06K G06F

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched
KR, JP IPC as above

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)
ESPACENET, JPO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 99/28701 A (KONINKLIJKE PHILIPS ELECTRONICS N. V.) 10 JUNE 1999 see whole document	1-20
Y	JP 11-283026 A (MATSUSHITA ELECTRIC IND. CO. LTD) 15 OCTOBER 1999 see whole document	1-20
A	KR 1999-15774 (SAMSUNG ELECTRONICS LTD.) 5 MARCH 1999 see whole document	1-20

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevence; 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 relevence; 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	Date of mailing of the international search report
23 MAY 2001 (23.05.2001)	28 MAY 2001 (28.05.2001)

Name and mailing address of the ISA/KR	Authorized officer
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