OPTICAL SCANNING-TYPE TOUCH PANEL

TECHNICAL FIELD

[0001] The present invention relates to an optical scanning-type touch panel for optically detecting the position and size of an indicator on a display screen of a display device on which information is displayed by a computer system, etc.

BACKGROUND ART

[0002] With the spread of computer systems, mainly personal computers, a device for inputting new information or giving various instructions to a computer system by pointing at a position on a display screen of a display device on which information is displayed by the computer system, with a person's finger or a specific object, has been used.

[0003] In order to perform an input operation with respect to the information displayed on the display screen of the display device of such a personal computer or the like by a touching method, it is necessary to detect a touched position (indicated position) on the display screen accurately. As a method of detecting the indicated position on such a display screen serving as a coordinate surface, the "Carol method" (U.S. Pat. No. 4,267,443) has been known. According to this method, light emitting elements and light receiving elements are arranged to face each other on the frame of the front surface of the display screen so as to construct an optical matrix on the front surface of the display screen, and a position where light is cut off by the touch of a finger or pen is detected. According to this method, a high SIN ratio is obtained, so the application of this method can be extended to a large-sized display device, but since the resolution of detection is in proportion to the arrangement intervals of the light emitting elements and light receiving elements, it is necessary to reduce the arrangement intervals in order to increase the resolution of detection. Therefore, in order to accurately detect a touched position even when a large-sized screen is touched by a thin object such as a point of a pen, such problems arise that the number of light emitting elements and light receiving elements to be arranged is increased and thus the structure becomes bulky, and signal processing becomes complicated.

[0004] In addition, another optical position detecting method is disclosed in Japanese Patent Application Laid-Open No. 57-211637/1982. According to this method, a focused light such as a laser beam is scanned angularly from the outside of a display screen, an angle of a position where a special pen exists is calculated from two timings of reflected light from the special pen having a reflecting member, and the resultant angle is applied to the triangulation principle so as to detect the coordinate of the position by calculation. This method can reduce the number of parts significantly, and can provide high resolution. However, there are problems in the operability, for example, a special reflecting pen must be used, and the position of a finger, an arbitrary pen or the like cannot be detected.

[0005] Still another optical position detecting method is suggested in Japanese Patent Application Laid-Open No. 62-5428/1987. According to this method, a light retro-reflector is arranged on frames on both sides of a display screen, return light from the light retro-reflector of an angularly scanned laser beam is detected, an angle of a position where a finger or pen exists is calculated from the timing that the light beam is cut off by a finger or pen, and the coordinate of the position is detected from the resultant angle according to the triangulation principle. In this method, detecting accuracy can be maintained with a small number of parts, and the position of a finger, arbitrary pen or the like can be detected.

[0006] Moreover, an optical detecting method capable of detecting not only the position but also the size of a finger, arbitrary pen or the like is proposed in Japanese Patent Application No. 9-254220/1997 by the same applicant of the present invention. In this method, at least two light transmitting and receiving sections for angularly scanning laser beam in a plane substantially parallel to a display screen are disposed in the corners of the display screen, a light retro-reflector is arranged along at least three sides of the display screen, a scanning light cut-off region by an indicator such as a finger and pen in a scanned plane is measured, and the position of the indicator in the scanned plane is calculated according to the principle of triangulation and also the size of the indicator is calculated.

[0007] According to the above-described three conventional examples in which light is angularly scanned, the light emitting element and the light receiving element for receiving reflected light are juxtaposed so as to construct the light transmitting and receiving section in a small size, and there is a possibility that a part of the foot of laser beam emitted from the light emitting element to perform optical scanning is directly incident on the light receiving element at a position where the scanning angle is small. When the laser beam from the light emitting element is directly incident on the light receiving element, the output level of the light receiving element varies, the directly incident light is mistakenly recognized as reflected light, the scanning light cut-off region is not calculated accurately, and consequently such a problem arises that the correct position or size of the indicator cannot be calculated.

[0008] A main object of the present invention is to provide an optical scanning-type touch panel, capable of accurately measuring a scanning light cut-of region and thereby calculating the correct position or size of an indicator, by switching a threshold value with respect to an output of a light receiving element for judging whether a region is a cut-off region, in a plurality of stages according to the scanning angle.

DISCLOSURE OF THE INVENTION

[0009] An optical scanning-type touch panel according to the present invention comprises a light retro-reflecting member disposed outside a predetermined area; at least two light transmitting and receiving sections, each having an optical scanner for angularly scanning light in a plane substantially parallel to the predetermined area and a light receiving element for receiving reflected light from a portion of the light retro-reflecting member, which portion was illuminated with light; a measuring section for measuring a scanning light cut-off region formed in the predetermined area by an indicator, according to the scanning angle of the optical scanner and the result of receiving light by the light receiving element; a calculating section for calculating the position and size of the indicator based on the result of the measurement performed by the measuring section; an angle detect-