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JP61084729A 1986-04-30 **THROUGH-VISION FINGER TOUCH INPUT DEVICE** (en)**English Abstract:**

PURPOSE: To maintain high reliability and to minimize the error of a detected coordinates position by making the finger tip approach to the crossover of respective electrodes and detecting a coordinates position with the change of static capacity.

CONSTITUTION: On a display surface 1 of CRT, etc., a film-shaped straight line-shaped transparent conductive electrode X_n is installed mutually in parallel and at constant pitch PX as the first electrode, and the second electrode Y_n is installed in the same manner intersecting orthogonally with the first electrode X_n. A transparent film-shaped conductive material 2 lies between both electrodes X and Y intersecting positions, and both these electrode surfaces and a conductive material are covered with a transparent film-shaped insulating material 3, and installed tightly on the display 1. Thus, when the finger tip through the insulating material 3 touches the intersecting position, a capacity increases in accordance with a human body effect and a voltage of detecting output terminals becomes unbalanced. The result is applied to the data processing device, etc., and the coordinates position can be detected by means of the finger touch.

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Description

1. Title of the Invention

A transparent type finger touch input device

2. Claims

A transparent type finger touch input device comprising:

a plurality of straight first electrodes parallel to each other, made of a transparent conductive material provided on a display surface;

a plurality of straight second electrodes parallel to each other, made of a transparent conductive material, crossing each first electrode, provided on said display surface;

a transparent dielectric material for forming a predetermined electrostatic capacity between the interposed and opposed electrodes at at least each intersection between the second electrodes and the first electrodes;

a transparent insulator material for covering each electrode from the surface side;

a detection circuit for detecting a change of electrostatic capacity at each intersection, as a coordinate position of the intersection.

3. Detailed Description of the Invention

[Field of industrial application]

The present application relates to an input device for providing an instruction to input information by a touch of a finger tip to a predetermined coordinate position on a display surface of a cathode ray tube (hereinafter referred to as CRT) display device or the like.

[Prior art]

The input device has been used in a CRT display device or the like attached to each kind of data processor such as a computer, control device or the like. Conventionally, as disclosed in "A transparent type finger touch input device with a coordinate detection surface superimposed on a display screen", "Nikkei Electronics", Nikkei McGraw Hill Company, June 8, 1981, Pages 122-137, a means is generally used for detecting a conduction by contact between perpendicularly crossing electrodes by a touch of a finger tip, for which a set of electrodes using a transparent conductive material, perpendicularly crossing to each other, is provided on the display screen of the CRT, and a gap is provided between these opposing surfaces, or a means is generally used for detecting a light shielding by a finger tip to determine a coordinate position, for which a plurality of light beams are projected from sides perpendicular to each other to the surface of the CRT and each light beam is received at the side opposing to this.

[Problem to be solved by the invention]

However, on the one hand in the former means, a transparent and conductive

material film which constitutes the set of electrodes may be poor in restoring force and be in contact semi-permanently. On the other hand in the latter means, since the surface of the CRT curves and the light beam straightly advances, in a circumferential part of the surface of the CRT a defect is caused, such as a distance between the surface of the CRT and the light beam becomes large, a difference between a position touched by a finger tip carried out on the basis of a display on the CRT and a coordinate position detected by shielding a light beam becomes large, an error is generated in detecting an information input position, or the like.

The object of the present invention is to radically solve the above conventional problem, and to provide a transparent type finger touch input device which is reliable and extremely effective for not-generating an error in a manner to detect.

[Means for solving problem]

For this, the invention comprises the following means.

That is, a plurality of straight first electrodes parallel to each other, made of a transparent conductive material, a plurality of second electrodes crossing these, which is similar to the first electrodes, and a transparent dielectric material for forming a predetermined electrostatic capacity between the interposed and opposed electrodes at at least each intersection between the second electrodes and the first electrodes are provided on a display surface, and the surface of each electrode is covered with a insulator material and a detection circuit for detecting a change of electrostatic capacity at each intersection as a coordinate position of the intersection is provided.

[Operation]

Therefore, if a finger tip is brought close to an intersection of the electrodes, electrostatic capacity at the intersection is changed by effect on a human body, this is detected as a coordinate position, and depending on this an input of information by a touch of a finger tip is performed.

[Example]

Here, the details of the present invention will be specifically described with referent to the figures which show examples of the present invention.

Fig. 1 represents a disassembled oblique view, in which electrodes X_n , X_{n+1} made of film-like and straight transparent conductive material as a first electrode are provided parallelly to each other and at a specified pitch P_x , and similar electrodes Y_n , Y_{n+1} perpendicularly crossing these, as a second electrode, are provided at a specified pitch P_y , a transparent film-like dielectric material 2 is interposed at at least these intersections, thereby a predetermined electrostatic capacity is formed between the electrodes X_n , X_{n+1} and the electrodes Y_n , Y_{n+1} which oppose to each other.

A transparent film-like insulator material 3 is provided on a surface side of each electrode X_n , X_{n+1} , Y_n , Y_{n+1} , thereby each electrode X_n , X_{n+1} , Y_n , Y_{n+1} and the dielectric material 2 are covered with this, and these are integrally stacked and then are provided with a close contact with the display surface 1.

Fig. 2 represents a circuit diagram of a detection circuit. Electrodes X_0 - X_1 are connected through a set of switches SW_x to one input I_1 or the other input I_2 of a differential amplifier DA individually or they are not connected. On the one hand the electrodes Y_0 - Y_5 are connected through a set of switches SW_y to a common potential or a high-frequency power source (hereinafter referred to as a power source) HFG, and on the other hand a set of switches SW_y and SW_x are controlled by a control section CONT such as a micro-processor or the like and each switch Sy_0 - Sy_5 of the set of switches SW_y is sequentially and repeatedly driven from a state which the common potential is commonly selected to a state which the power source HFG is selected.

Each switch Sx_0 - Sx_4 of the set of switches SW_x is normally in a neutral state. However, for every cycle period which drives of the switches Sy_0 - Sy_5 take a round, switches adjacent to each other are driven as a pair, and if ones of a succeeding order select the input I_1 , then ones of the next order select the input I_2 , and this is sequentially and repeatedly performed by every pair.

Therefore, during a period when the electrodes Y_0 - Y_5 are sequentially connected to the power source HFG, first, the electrode X_0 is connected to the input I_1 and the electrode X_1 is connected to the input I_2 , and during a next similar period the electrode X_1 is connected to the input I_1 and the electrode X_2 is connected to the input I_2 , thereafter sequentially, the electrodes X_2 and X_3 , X_3 and X_4 , X_4 and X_0 and again X_0 and X_1 are individually connected to respective I_1 and I_2 , and then a similar processing is repeated.

On the other hand, since electrostatic capacities C_{00} - C_{45} (hereinafter referred to as capacities) formed at intersections between the electrodes X_0 - X_4 and the electrodes Y_0 - Y_5 are approximately the same value respectively, and for example when the electrode Y_0 is connected to the power source HFG and the electrode X_0 is connected to the input I_1 and the electrode X_1 is connected to the input I_2 , the capacities C_{00} and C_{10} are approximately the same, currents flowing through resistors R_1 , R_2 inserted between the input I_1 , I_2 and the common potential are approximately the same, these terminal voltages are generated as approximately the same values, both the input voltages are offset in a differential amplifier DA, and a detection output is not sent.

To this, If a finger tip is touched through the insulator material 3 to the intersection between the electrode X_0 and the electrode Y_0 , the capacity C_{00} is increased to $C_{00} + \Delta C$, an current of $i_{X_1} > i_{X_2}$ flows from the power source HFG to the electrodes X_0 , X_1 as shown in Fig. 3 regarding a detection condition, in accordance with this, the terminal voltages of the resistors R_1 , R_2 are in an unbalanced state, and the difference between both the input voltages is sent as a detection output DO.

Then, since this is converted to DC by a detection circuit DET and provided to the control section CONT, the control section CONT determines order of switches selecting the input I_1 and selecting the power source HFG depending on the signals controlling the switches SW_x , SW_y , coordinate signals DS_x , DS_y indicating

coordinate positions which the detection is performed are sent and this is provided to a data processing device (omitted on the figure), a coordinate position which an input instruction of information is made by touching with a finger tip can be detected.

Therefore, if a width W and pitches P_x , P_y of each electrode X_0 - X_4 , Y_0 - Y_5 are determined depending on a detection accuracy of a coordinate position indicated by each electrode X_0 - X_4 , Y_0 - Y_5 , a degree of effect of a human body, the frequency of the power source HFG, a dielectric constant of the dielectric material or the like, a finger tip touching coordinate position can be reliably detected with sufficient accuracy.

Since the electrodes are integrated, that is reliable, and since the display surface 1 curves but each electrode is film-like, it has a closed contact to the display surface 1 and an error is not generated between a display by a CRT or the like and a position detected by a touch of a finger tip.

In addition, ITO (Indium Tin Oxide) or the like may be used for each electrode X_0 - X_4 , Y_0 - Y_5 , and various kinds of transparent dielectric materials may be used as a dielectric material 2.

However, as a display surface, not only a CRT but also each kind of display device surface may be used. A case that electrodes X_0 - X_4 and Y_0 - Y_5 are crossed with a predetermined angle may be the same. Electrodes X_0 - X_4 and Y_0 - Y_5 and a dielectric material 2 may not be directly formed onto a display surface 1, and these may be manufactured as a separate film (or films) to be applied to the surface. And also in Fig. 3, the relationship between electrodes X_0 - X_4 and Y_0 - Y_5 may be opposite to the above, and a control section CONT, a differential amplifier DA or the like may be replaced with other identical one.

The respective numbers of electrodes X_0 - X_4 and Y_0 - Y_5 may be determined depending on the condition to be used. A dielectric material 2 may be interposed over the whole surface between the electrodes instead of at only each intersection in a similar way. Various kinds of modification including these may be freely applied.

[Effect of the invention]

As is clear from the above description, according to the present invention, since any mechanical displacement is not used and a capacity change by a finger tip is detected, a noticeable effect as a finger touch input means which can be reliable, can not cause an error on a detection coordinate position, and can use various kinds of display devices is obtained.

4. Brief description of drawings

The drawings show examples of the embodiments of the present invention, Fig. 1 represents a disassembled oblique view, Fig. 2 represents a circuit diagram of a detection circuit, and Fig. 3 represents a circuit diagram showing a detection condition.

1·····a display surface, 2·····a dielectric material, 3·····an insulator material, X_n , X_{n+1} , X_0 - X_4 ·····electrodes (first electrodes), Y_n , Y_{n+1} , Y_0 - Y_5 ·····electrodes (second electrodes), P_x , P_y ·····pitch, W ·····width, HFG·····a power source (high-frequency

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