TOUCH TECHNOLOGY

[0001] The present invention relates to touch detection, proximity detectors and touch sensitive surfaces and devices.

[0002] There are many known examples of devices which are able to detect the touch, or close proximity, of an object. Some are based on the use of membrane switches having two sets of conductors held in opposed relation, which require the exertion of pressure at an intersection of two conducting elements in order to form an electrical connection. Disadvantages of these devices are that the surface must actually be touched and the positioning of the user's finger must coincide with the conducting element intersection. Moreover, membrane switches include moving parts which are subject to wear and tear and therefore do not make robust sensing devices.

[0003] An alternative sensing device uses an array of proximity sensing conductors and relies upon variations in capacitance of the conductors to detect the exact position of a finger which is in contact with a sensing layer supporting the conductors, or in close proximity to the conductors. Such a sensing device is described in U.S. Pat. No. 6,137,427 awarded to Binstead, and is shown in **FIG. 1**, wherein an array of horizontal and vertical sensing conductors **2**, which are electrically isolated from each other, are arranged into a grid structure and are supported by an electrically insulating membrane **3**. The membrane **3** and array of conductors **2** form the sensing layer of a touchpad, as shown in **FIG. 2** as a side cross sectional view along the line A-B of the device of **FIG. 1**. When a finger **1**, or similar object, touches or comes close to the surface of the sensing layer, the finger induces a change in the capacitance of a conductor **2**, or group of conductors, in the sensing layer. Using suitable scanning apparatus to scan each conductor **2** in turn, the variation in capacitance of a conductor **2** can be measured and therefore the touch, or proximity, of the finger **1** may be detected. By detecting changes in capacitance on more than one conductor **2**, the exact position of the touch, or proximity, of the finger **1** may be determined by interpolating between the conductor positions. Hence, capacitive devices are able to detect the position of the finger **1** between sensing conductors **2**, and therefore are not constrained to detection at intersections of conductors, unlike the aforementioned membrane switch devices.

[0004] However, a disadvantage of conventional capacitive devices is that difficulty arises when the sensing conductors **2** are widely spaced apart, since a touch, or close proximity, of a finger **1** between the conductors generally gives rise to only limited data values for the interpolation process, thereby leading to errors in calculating the exact position of the finger.

[0005] Moreover, conventional capacitive devices suffer from a further problem which occurs whenever a palm of a hand is held just above the device, since a palm induces a strong signal which can be falsely identified as a touching action. This can be particularly disadvantageous since a user must be continually aware of the position of their hands in relation to the device, while deciding upon their next true touching action.

[0006] It is to be understood that throughout the present specification, reference to 'finger' is intended to include any object capable of being used to locally modify the capacitance to an extent that detection is possible by way of capacitive sensing. Furthermore, any references to 'touching' or 'touching action' are to be taken to include both physical touching of a surface and the bringing of a finger into close proximity to a surface.

[0007] An object of the present invention is to solve at least some or all of the above problems.

[0008] The present invention is directed towards the construction of a touch detection system comprising a means to alter the immediate capacitive environment of the system. The means may be adapted so that variations in capacitance are propagated by high levels of capacitive coupling or adapted to allow the variations to propagate directly via electrical conductivity. Alternatively, the means may be adapted to support both of these electrical effects.

[0009] One aspect of the present invention is to provide a method of altering the immediate capactive environment of a subset of the first and second series of conductors of a capacitive touch detection system, to improve the accuracy and speed of touch detection of the system.

[0010] Another aspect of the present invention is to provide a mixture of resistive environments to control the pattern of touch detection in a proximity detection system.

[0011] Another aspect of the present invention is to provide a conductive and/or capacitively coupled medium to physically distort the detection environment of a proximity detection system.

[0012] According to a another aspect of the present invention there is provided a touchpad apparatus, comprising:

[0013] a supporting medium supporting a plurality of spaced apart conductors in which there is no electrical contact between the conductors, each conductor being sensitive to the proximity of a finger to modify the capacitance of said conductor to detect the presence of said finger positioned close to that conductor, the touchpad further comprising a means to concentrate electric field between conductors towards the plane of the supporting medium.

[0014] According to another aspect of the present invention there is provided a touchpad system including a touchpad according to the first aspect of the present invention, including:

[0015] a touch sensing and wake up circuit; and

[0016] a position sensing circuit which is normally asleep and periodically wakes to measure the state of the touchpad, where in response to a touch, the touch sensing circuit wakes up the position sensing circuit which then scans the surface to determine the touch position.

[0017] Embodiments of the present invention will now be described by way of example and with reference to the accompanying drawings in which:

[0018] **FIG. 1** shows a top plan view of a sensing conductor arrangement for a touchpad.

[0019] **FIG. 2** shows a conventional touchpad in side cross section on the line A-B through the touchpad layout of **FIG. 1**.