SCANNING OF A TOUCH SCREEN

THE BACKGROUND OF THE INVENTION AND PRIOR ART

[0001] The present invention relates generally to solutions for scanning a touch screen in search of objects positioned on the screen to indicate input commands. More particularly the invention relates to an interface arrangement according to the preamble of claim **1**, a mobile terminal according to the preamble of claim **9** and a method of generating input commands according to the preamble of claim **10**. The invention also relates to a computer program product according to claim **17** and a computer readable medium according to claim **18**.

[0002] The current trend in mobile and portable devices is that the devices are made physically smaller and smaller. At the same time, the devices are provided with more functionality and processing capacity. Therefore, flexible user interfaces are required to enable efficient input of commands and data, while allowing presentation of complex information. To this aim, touch screens and other types of multi-purpose interface means are highly useful.

[0003] US 2004/0263482 discloses a touch screen arrangement for a mobile telephone. Here, in addition to a display unit, the touch screen includes a number of light pulse emitting elements and a number of light receiving elements, which are arranged along the edges of the display unit. The emitting elements generate light pulses according to a predetermined sequence, and based on light energy registered by the receiving elements, it is determined whether or not a light-obstructive object (e.g. a fingertip) is present on the display unit. Hence, user-generated commands can be fed into the telephone.

[0004] However, depending on the conditions in which the telephone is operated the energy level received by the light receiving elements may vary substantially. For instance, when operated in direct sunlight, the received energy level is typically many factors of ten higher than the energy level received when the unit is operated in a dark or shaded environment.

SUMMARY OF THE INVENTION

[0005] The object of the invention is therefore to alleviate the above problems, and present a reliable and efficient solution for scanning a touch screen optically.

[0006] According to the invention, the object is achieved by the interface arrangement as initially described, wherein the processing unit is adapted to record an initial measurement value registered by at least one detector in the at least one array of light detectors prior to transmitting the light pulse. Thus, the initial measurement value represents an ambience light intensity. The processing unit is specifically adapted to determine whether or not a light-obstructive object is present on the display device based on the initial measurement value and a secondary measurement value registered by at least one light detector during emission of light from the light source.

[0007] The proposed arrangement is advantageous because the light detection is made relative to the ambience light intensity. Therefore, the effects of any variations in the surrounding light conditions can be cancelled out.

[0008] According to one preferred embodiment of the invention, the display device has a rectangular outline with four separate sides, and the at least one second side represents a respective side opposite to the at least one first side. Hence, each light detector may expediently register light pulses from one or more light sources.

[0009] According to another preferred embodiment of the invention, the interface arrangement includes a selection means adapted to control the at least one array of light sources to emit light from a given light source during a specified interval. Thereby, the predefined sequence of light pulses can be effected in a straightforward manner.

[0010] According to yet another preferred embodiment of the invention, the processing unit is adapted to cause pre-charging of at least one detector in the at least one array of light detectors in coordination with the light emitted from the given light source, such that the pre-charging is initiated at least a threshold time prior to a start of a specified interval. Namely, this enables registration of the initial measurement value representing the ambience light intensity.

[0011] According to still another preferred embodiment of the invention, the interface arrangement includes a digitizing unit, which is configured to receive measurement values from the at least one array of light detectors and in response thereto deliver digital data to the processing unit. Preferably, the processing unit is further configured to initiate the emission of light from a given light source no earlier than after that digital data representing the initial measurement value has been received by the processing unit. Consequently, it is ensured that the initial measurement value exclusively represents the ambience light.

[0012] According to another preferred embodiment of the invention, the processing unit is configured to control the at least one array of light sources such that each light pulse has a duration exceeding a conversion time of the digitizing unit for producing the digital data based on the received measurement values. Thereby, good data quality can be guaranteed, and thus also a reliable behavior of the proposed interface.

[0013] According to a further preferred embodiment of the invention, the processing unit is configured to cause pre-charging of at least one detector in the at least one array of light detectors in coordination with the light emitted from the given light source, such that the pre-charging is terminated no earlier than a delay time after expiry of the specified interval during which light is emitted from the given light source. The delay time here represents a conversion time of the digitizing unit for producing the digital data based on the received measurement values. The delay time is desirable because it enables detection of a maximum amount of energy in the emitted light pulse.

[0014] According to another aspect of the invention the object is achieved by the terminal described initially, wherein the terminal includes the interface arrangement of the above-proposed type.

[0015] According to yet another aspect of the invention, the object is achieved by the method described initially, wherein an initial measurement value is recorded, which has been registered by at least one detector in the array of light detectors prior to transmitting the light pulse. The initial measurement value thus represents an ambience light intensity. It is then determined whether or not a light-obstructive object is present on the display device based on the initial measurement value and a secondary measurement value registered by at least one light detector during emission of light from the source. The advantages of this method, as well as the pre-