# HUMAN INTERFACE DEVICE AND RELATED METHODS

## FIELD OF THE INVENTION

**[0001]** Embodiments of the invention relate to a human interface device arranged to be used with electronic devices. In particular, but not exclusively, embodiments relate to a human interface device for a hand-held electronic device, such as a cell-phone, a PDA (Portable Digital Assistant), a Netbook, or the like.

## BACKGROUND OF THE INVENTION

**[0002]** Consumer electronic devices, such as cell phones (sometimes referred to as mobile 'phones), are becoming more and more popular with currently over two billion such devices across the globe. With such a large market and an ever growing number of sophisticated consumers, designers and engineers must integrate more and more advanced value added features to their product offerings to maintain consumer loyalty. Even as features are added to cell phones consumers still desire a small product footprint which presents a real challenge as every function added needs to be initiated by a user input command upon a button or target capable of detecting the presence of a human finger tip and to provide a tactile acknowledgement of the command in some form of haptic representation like an icon must be provided. This trend of miniaturization and feature expansion is unlikely to coexist indefinitely.

**[0003]** Whilst it is convenient to refer to cell 'phones, as the skilled person will readily appreciate these, he/she will also appreciate that the features discussed and associated problems are not limited to just cell phones. Devices such as watches, PDA's, remote controls, netbook computers, notebook computers, or any other, typically hand held, electronic device have similar considerations.

**[0004]** Conventional wisdom calls for more keys and icons to be added to the cell phone user interface. Currently the cell phone market is split between graphic/video type displays and conventional key entry devices full keypads, some sporting as many as forty to fifty keys. As stated, the problem with this approach is that many mobile devices, including cell phones, are getting smaller and thinner and user data entry real estate is shrinking. When too many keys are clustered in a small space user confusion and frustration with the operation of the device is inevitable. When inter digit spacing is reduced too much to accommodate the addition of too many keys average human sized hands and fingers can no longer comfortably enter data on the keypad.

**[0005]** Some cell phone manufacturers like Apple™ attempt to address the overcrowded user interface by deploying a capacitive sensing touch screen overlay that resides atop a video display. Conventional fixed location user keys and icons are replaced by dynamic high resolution graphics. Although this approach is presently considered to be the preferred state of the art in cell phone user interface technology, the maximum physical usable space is a mere 2 inch by 3 inch area or that of a common business card. In an attempt to overcome the space challenge the iPhone™ initially only displays Alpha keys (i.e. the letters of the alphabet). To utilize numerical and punctuation keys the user has to manually select another screen then return again to the first screen. The iPhone™ and other similar technologies that use capacitive type touch screens for user data entry suffer from display visibility during data entry as the act of entering data severely occludes the view of the screen; i.e. screen real-estate is used to display the keys themselves thus reducing the available display for other features.

## SUMMARY OF THE INVENTION

**[0006]** According to a first aspect of the invention there is provided a Human Interface Device (HID) comprising:

**[0007]** a capacitive sensing layer arranged to provide at least one coordinate location where a user touches the device;

**[0008]** a circuit layer comprising a plurality of tracks each track having a at least one break therein; and

**[0009]** a plurality of user activatable domes positioned above the breaks such that upon user activation, the dome performs one of completing the track by bridging the break and breaking the track by un-bridging the break.

**[0010]** Such a device is believed advantageous as it allows the HID to use inputs generated by the capacitive sensing layer to modify the behaviour of buttons provided by the combination of the circuit layer and user activatable domes whilst providing the positive tactile feedback given by the domes. As such, embodiments of the HID may operate in a similar manner to a track pad or the like in which the capacitive sensing layer allows a user's gestures on the HID to be used as an input.

**[0011]** The skilled person will appreciate that generally, the dome will bridge a gap since this is likely to be mechanically easier to fabricate. However, the mechanical inverse in which the dome is arranged to break a track, upon activation thereof, is equally possible.

**[0012]** The HID may also comprise a display layer arranged to provide a display to a user of the HID.

**[0013]** The display layer may be arranged to provide a Graphical User Interface (GUI) which may provides keys, or other icons, that a user can manipulate through his/her touch. Such a GUI is advantageous as it can represent a change of behaviour of a button caused by a user's interaction with the HID as sensed by the capacitive sensing layer.

**[0014]** In one embodiment, the HID is arranged to modify the behaviour of a button provided by a dome depending on user actions.

**[0015]** The HID may be arranged to modify the behaviour of a button provided by a dome according to the length of time a user hovers his/her finger over a button. For example, if a user were to hover his/her finger over the button for more than a predetermined time then the functionality of the button may change.

**[0016]** There may be more than one predetermined time. For example the HID may be arranged to have a base functionality for a button provided to a dome. This base functionality may be modified from the base functionality to a first modified functionality after a first predetermined time and subsequently modified to a second functionality after a second predetermined time. The first and second predetermined times need not be the same.

**[0017]** The first and/or the second predetermined time may be substantially any of the following: 0.5s, 1s, 2s, 3s, 4s or the like.

**[0018]** The direction of motion of a user's finger(s) and/or thumbs, as sensed by the capacitive sensing layer prior to a press of a button provided by a dome, may alter the functionality of that button. For example, if a user moved his/her