

within a system, and particularly when connectable on a wireless basis in a network in which voice, text messaging, and other data transfer are accommodated.

[0035] As shown in FIG. 1, the handheld device **300a** is cradleable in the palm of a user's hand. The handheld device **300a** is provided with an adaptive display screen **322** for communicating information to a user, and a full alphabetic key arrangement **280** on the display screen **322** to enter text data and place telephone calls. In one embodiment, a set of navigational inputs **190**, which are physical and fixed to the front face **370** of the handheld device **300a** are provided below the display screen **322** on the handheld device **300**. This set of navigational inputs **190** allow the user to navigate through an application page shown on the display screen **322**. In this set of navigational inputs **190**, a connect/send key **6** is preferably provided to assist the user in placement of a phone call. Additionally, a disconnect/end key **8** is provided. The connect/send key **6** and disconnect/end key **8** preferably are arranged in a row that includes an auxiliary input device **328** in the form of a navigation tool which is a trackball navigation tool **325** in at least one embodiment. The menu key **7** is used to bring up a menu on the display screen **322** and the escape key **9** is used to return to the previous screen or previous menu selection. While the navigational inputs **190** in this embodiment are arranged using physical inputs, other embodiments do not have a physical navigation row and use only navigational keys shown on the display of the handheld device **300**.

[0036] As further illustrated in FIG. 1, the adaptive display screen **322** includes a full alphanumeric key arrangement **280** that is configurable to a different key arrangement. Other examples of the visibly different key arrangements are presented in FIGS. 2B and 11-15. The display screen **322** presents these visibly different key arrangements through a display mechanism which can be a LCD screen. The details regarding layers of material involved in the construction of these adaptive display screens **322** are described below in relation to FIGS. 3A-3C.

[0037] An exemplary embodiment of the technology described in this disclosure concerns an adaptive display screen **322** with a shape-changing upper surface. The adaptive display screen **322** is configured for incorporation on a multi-mode, microprocessor-controlled wireless handheld device **300**. The handheld device **300** can be a two-way mobile communication device having electronic messaging communications capabilities and possibly also voice communications capabilities. Depending on the functionality provided by the handheld device **300**, in various embodiments the handheld device **300** may be a data communication device, a multiple-mode communications device configured for both data and voice communication, a mobile telephone, a personal digital assistance (PDA) enabled for wireless communication, among other things.

[0038] The adaptive display screen **322** comprises a visual display that variously presents visibly different key arrangements to an operator or user of the handheld device **300** in dependence upon the mode of operation of the incorporating handheld device **300**. Examples regarding the visibly different key arrangements are presented herein below. These examples are provided for illustrative purposes and are not intended to limit the presentation of the visibly different key arrangements to the ones described below.

[0039] Additionally, the adaptive display screen **322** comprises a shape-adaptive, exposed upper surface presented to the operator for digital press-engagement. The exposed upper

surface changes shape in dependence upon the presented key arrangement. Examples of these changes in shape are presented herein below, but the shapes are not limited to those described herein and could take other forms as one skilled in the art would understand.

[0040] Further, the adaptive display screen **322** comprises a display presented key arrangement taking the form of one of the following: a navigational key arrangement, a text entry key arrangement, a symbol entry key arrangement and numeric entry key arrangement. These examples are provided for illustrative purposes and are not intended to limit the presentation of the visibly different key arrangements to the ones described below.

[0041] Analogously, the variously presentable visibly different key arrangements comprise a navigational key arrangement, a text entry key arrangement, a symbol entry key arrangement, and numeric entry key arrangement. Each visibly different key arrangement presents a plurality of discrete keys that each visibly define a two-dimensionally signified key zone and also establishes a shape-adaptive target area. The exposed upper surface presents a corresponding tactilely perceptible key zone for each of a plurality of the discrete keys. Each tactilely perceptible key zone likewise has substantially the same shape.

[0042] The shape-adaptive exposed upper surface constitutes an upper portion of a shape-adaptive overlay to the adaptive display screen **322**. The shape-adaptive overlay comprises a plurality of size-alterable zones that change the shape of the exposed upper surface in dependence upon a microprocessor-controlled volumetric change of at least one of the size-alterable zones.

[0043] In addition, the size-alterable zone located above at least one of the visibly defined key zones is expanded to thereby establish a tactilely perceptible convex area on the shape-adaptive exposed upper surface that physically signifies the respective overlaid visible key zone. This tactilely perceptible convex area is centered within one of the visibly defined key zones. Also, the size-alterable zone located above at least one of the visibly defined key zones is contracted to thereby establish a tactilely perceptible concave area on the shape-adaptive exposed upper surface that physically signifies the respective overlaid visible key zone.

[0044] Furthermore, the size-alterable zone, located above at least one of the visibly defined key zones, comprises electrically responsive media that changes volume when electrically stimulated. The electrically responsive media is confined within a pocket formed in the flexible sheet upon which the shape-adaptive exposed upper surface is established. The flexible sheet is composed of substantially transparent material which permits and accommodates visualization of the adaptive display screen **322** therethrough.

[0045] In another embodiment, the size-alterable zone is a solid electrically responsive media. In this arrangement as shown in FIG. 3D, solid shape adaptive upper surface **207** is controlled to respond to the activation layer **206** located beneath the solid shape adaptive upper surface **207**.

[0046] The adaptive display screen **322** is capable of variably presenting visibly different key arrangements to an operator of the device **300**. These different key arrangements can be shown to the user through the display screen **322**. This enables the key arrangement to be tailored to a specific application running on the handheld device **300** or mode in which the device **300** is currently operating. Some examples of programs that the device **300** could be capable of running