tially varying sensory stimulation provides the user with an indication of the layout of the touch-sensitive areas of the touch screen interface.

[0076] In addition to the spatially varying sensory stimulation, the controller **216** may direct the switch array **217** to produce a temporally varying (time-dependent) electrosensory stimulation, which can be used for a wide variety of useful effects. For instance, the temporally varying electrosensory stimulation can be used to indicate a detected activation of a touch-sensitive area ("key press"). This embodiment address a common problem associated with prior art touch screen devices, namely the fact that a detection of a key press produces no tactile feedback. Prior art application-level programs used via touch screen devices may provide visual or aural feedback, but such types of feedback exhibit the various problems described earlier. In addition, production of the visual or aural feedback from the application-level program causes a burden on the programming and execution of those programs. In some implementations of the invention, an interface-level or driver-level program provides a tactile feedback from a detected activation of a touch-sensitive area by using the temporally and spatially variant electrosensory stimulation, and such interface-level or driver-level programs can be used by any application-level programs. For example, the application-level programs can be coupled to the inventive touch screen interface via an application programming interface ("API") whose set of available functions includes the feedback generation described above.

[0077] The temporally and spatially variant electrosensory stimulation can also be used to change the layout of the touch-sensitive areas "on the fly". In hindsight, this operation may be considered roughly analogous to changing the keyboard or keypad layout depending on the application program or user interface screen currently executed. However, when prior art touch screen devices change keyboard or keypad layout on the fly, the new layout must be somehow indicated to the user, and this normally requires that the user sees the touch screen device.

[0078] Some embodiments of the inventive touch screen device eliminate the need to see the touch screen device, assuming that the layout of the touch-sensitive areas is sufficiently simple. For instance, up to about two dozen different "key legends" can be indicated to the user by providing different patterns for the temporally and spatially variant electrosensory stimulation. As used herein, the expression "key legend" refers to the fact that prior art touch screen devices, which produce no tactile feedback, normally produce visual cues, and these are commonly called "legends". In some embodiments of the present invention, the function of the key legends can be provided via different patterns. For instance, the following patterns can be identified with one fingertip: pulses with low, medium or high repetition rate; sweeps to left, right, up or down, each with a few different repetition rates; rotations clockwise or anti-clockwise, each with a few different repetition rates.

[0079] From the above, it is evident that the inventive electrosensory interface can produce a large number of different touch-sensitive areas, each with a distinct "feel" (technically: a different pattern for the temporal and spatial variation of the electrosensory stimulus). Hence the screen section of a conventional touch screen is not absolutely needed in connection with the present invention, and the term touch device interface should be interpreted as an interface device which, among other things, is suitable for applications commonly associated with touch screen devices, although the presence of the screen is not mandatory.

[0080] Moreover, the strength of the capacitive coupling between the inventive CEI and a body member of its user (or the capacitive coupling between an individual electrode or a group of electrodes and the user's body member) can be determined by direct or indirect measurements. This measurement information can be utilized in various ways. For instance, the strength of the capacitive coupling can indicate the body member's proximity to the electrode, or it can indicate touching the electrode by the body member. Such measurement functionality can be provided by a dedicated measurement unit (not shown) or it can be integrated into one of the blocks described earlier, such as the switch matrix **217**. The switch matrix **217** (or the optional dedicated measurement Unit) can send the measurement information to the controller **216** which can utilize it to vary the electric fields generated by the electrodes, by varying the voltage or frequency. In addition or alternatively the controller **216** may forward the measurement information, or some information processed from it, to a data processing equipment, such as the personal computer PC shown in FIG. **4**.

[0081] Yet further two or more inventive touch device interfaces can be interconnected via some communication network(s) and data processing equipment. In such an arrangement, the electrosensory stimulation provided to the users of the touch screen devices may be based on some function of all users' contribution to the proximity to their respective devices. In one illustrative example, such an interconnection of two (or more) touch screen devices can provide their users with tactile feedback whose strength depends on the sum of the areas of hands touch the touch-sensitive areas. This technique simulates a handshake whose strength reflects the sum of hand pressure exerted by both (or all) users. In another illustrative example, a music teacher might "sense" how a remotely located student presses the keys of a simulated piano keyboard.

[0082] FIGS. **10** through **13** are equivalent circuits (theoretical models) which may be useful in dimensioning the parameters of the capacitive coupling. FIG. **10** illustrates distribution of an electric field-generating potential in capacitive couplings when the apparatus is grounded. The underlying theory is omitted here, and it suffices to say that in the arrangement shown in FIG. **10**, the drive voltage e of an electrode is divided based on the ratio of capacitances C**1** and C**2**, wherein C**1** is the capacitance between the finger and the electrode and C**2** is the stray capacitance of the user. The electric field experienced by the finger is caused by voltage U**1**:

$$U_1 = \frac{C_2}{C_1 + C_2} e$$

[0083] This voltage is lower than the drive voltage e from the voltage source. In a general case the reference potential of the apparatus may be floating, as will be shown in FIG. **11**. This arrangement further decreases the electric field directed to the body member, such as finger.

[0084] For these reasons some embodiments of the invention aim at keeping the capacitance C**1** low in comparison to that of C**2**. At least capacitance C**1** should not be significantly higher than C**2**. Some embodiments aim at adjusting or con-