

the example of FIG. 6, the user has selected fingertip 514-FT of middle finger 514 to touch and activate input sensor 710. Input sensor 710 could be an arbitrary small input device or sensor. It should be noted that the size of input sensor 710 (720 shows a top view of input sensor 710) in this example is substantially smaller than fingertip 514-FT.

[0049] FIG. 8 shows an example of multiple input sensors 820 that are distributed on top of a support surface 810. In the example of FIG. 8, the user has selected (1) fingertip 513-FT of index finger 513 and (2) input sensor 822 out of all 12 input sensors 820 to touch and activate input sensor 822. In this example, input sensors 820 are shown as keypads or buttons. It should be noted that the size of input sensors 820 (830 shows a top view of input sensors 820) in this example are each substantially as small as fingertip 513-FT.

[0050] FIG. 9 shows input sensors 920 distributed in a similar fashion as in FIG. 8 with the difference that input sensors 920 are now underneath a surface 910. An example of support surface 910 is a touchscreen, whereby input sensors 920 are distributed underneath the touchscreen. In the example of FIG. 9, the user has selected (1) fingertip 513-FT of index finger 513 and (2) input sensor 922 out of all 12 input sensors 920 to touch and activate input sensor 922. Surface 910 could be transparent so that the user has the opportunity to recognize the location of each of the input sensors 920, or surface 910 could have markings or illustrations to help visualize and/or localize where the user should touch surface 910 in order to select the intended input sensor. It should be noted that the size of input sensors 920 (930 shows a top view of input sensors 920) in this example are each substantially as small as fingertip 513-FT.

[0051] FIGS. 5-9 show examples in which the user could activate the input sensor with a fingertip either by pressing the input sensor, touching the input sensor, flipping the input sensor, bending the input sensor, or the like. The present invention is not limited to the means by which the user activates an input sensor and as a person of average skill in the art to which this invention pertains would understand, the type of activation by a user is also dependent on the type of input sensor. FIG. 10 shows an example whereby the activation is expanded by including motion performed through the selected fingertip on the input sensor (or a stroke by the fingertip on the input sensor). FIG. 10 shows surface 1010 with an input sensor 1020. An example of such an input sensor 1020 is, for instance, a resistive membrane position element as is common in the art as an input device or sensor on notebook computers, personal digital assistants or personal pocket computers. FIG. 10 shows an exemplary motion or stroke 1030 by fingertip 513-FT on surface 1010 that would be recognized or sensed by input sensor 1020. It should be noted that the size of input sensor 1020 (1040 shows a top view of input sensor 1020) in this example could be substantially as small as fingertip 513-FT. However, as a person of average skill in the art to which this invention pertains would readily recognize, the size of input sensor 1020 and thereby the size of the motion or stroke 1030 is dependent on the sensitivity of input sensor 1020 and the ability of the input sensor 1020 to distinguish the different motions that one wants to include and correlate to different functions.

[0052] FIG. 11 shows an example of a system 1100 according to the present invention. System 1100 includes at

least one input sensor 1110. In order to identify the selected fingertip that activates input sensor 1110, system 1100 further includes an imaging means 1120. Imaging means 1120 images a part of the user's hand large enough to identify the selected fingertip touching and activating input sensor 1110. In case only one hand is defined in the corresponding relationship between fingertips and functions, then imaging means 1120 only need to be able to identify from the image the different fingertips from that hand in order to correctly identify the selected fingertip. In case both the left and right hand are defined in the corresponding relationship between fingertips and functions, then imaging means 1120 needs to be able to identify the different fingertips from the right and left hand in order to correctly identify the selected fingertip. Imaging means 1120 preferably images the dorsal site of the hand as shown in FIGS. 5-10. However, imaging means 1120 is not limited to only the dorsal site of the hand since it would also be possible to image the palm site of the hand.

[0053] Imaging means 1120 is preferably a miniature imaging means and could be a visible sensor, an infrared sensor, an ultraviolet sensor, an ultrasound sensor or any other imaging sensor capable of detecting part of the user's hand and identifying the selected fingertip. Examples of imaging means 1120 that are suitable are, for instance, but not limited to, CCD or CMOS image sensors.

[0054] Imaging means 1120 is located in a position relative to input sensor(s) 1110. Imaging means 1120 could be in a fixed position relative to input sensor(s) 1110 or imaging means 1120 could be in a non-fixed or movable position relative to input sensor(s) 1110, but in both cases the position of the input sensor(s) 1110 in the image frame has to be known to the image processing algorithm in advance, before processing the image frame. It would be preferred to have an imaging means 1120 that includes an auto-focus means for automatically focusing the part of user's hand and making sure that optimal quality images are acquired for the identification process. Furthermore, imaging means 1120 could also include automatic features to control and adjust the brightness, color or gray scaling of the image. Imaging means 1120 could also include optical elements, such as lenses or mirrors, to optimize the field of view or quality of the image. For instance, dependent on the location and distance between input sensor 1110 and imaging means 1120, imaging means 1120 could include lenses to ensure that imaging means 1120 enables a proper field of view to identify based on the acquired image the selected fingertip.

[0055] So far, imaging means 1120 is discussed in relation to the acquisition of one image. However, this would be just one possibility of imaging the selected fingertip using imaging means 1120. In case of one image, the image is preferably taken at the time input sensor 1110 is activated. In other words, the activation of input sensor 1110 triggers imaging means 1120 at which time the image is taken. Another possibility is that imaging means 1120 acquires a continuous stream of image frames, at a frame rate of, for instance, but not limited to, 30 fps. In case a continuous stream of image frames is acquired, imaging means 1120 is no longer triggered by input sensor 1110 and therefore the time of activation or time of contact of the selected fingertip is important to be obtained from the input sensor 1110 along with the