

continuous stream of image frames from imaging means **1120** in order to synchronize the images with the time of activation or time of contact.

[**0056**] In order to identify the selected fingertip and therewith the selected function, system **1100** further includes a processing means **1130** to process the inputs from input sensor **1110** and imaging means **1120**. The objective of processing means **1130** is to identify the selected function based on those inputs. Processing means **1130** preferably includes software algorithms that are capable of processing the different inputs and capable of capturing and processing the images. Processing means **1130** also includes the appropriate analog to digital conversion devices and protocols to convert analog signals to digital signals to make the inputs ready for digital processing. The input from input sensor **1110** to processing means **1130** provides information over:

[**0057**] (1) The fact that input sensor **1110** is activated or in case of multiple input sensors which input sensor **1110** out of the multiple input sensors is activated;

[**0058**] (2) The timing of the activation of input sensor **1110**;

[**0059**] (3) The electrical (e.g. resistive) changes as a function of time during the motion of the selected finger over input sensor **1110** in case motion is defined with respect to a function; and/or

[**0060**] (4) The coordinate of the contact point of the selected fingertip with input sensor **1110**, supplied by input sensor **1110** in case when input sensor **1110** is substantially larger than the fingertip.

[**0061**] The input from imaging means **1120** to processing means **1130** includes:

[**0062**] (1) An image of a part of the user's hand large enough to identify from the image the selected fingertip taken at the time of activation; or

[**0063**] (2) A continuous stream of image frames of a part of the user's hand whereby each image is large enough to identify from the image the selected fingertip. In this case imaging means **1120** also provides to processing means **1130** a timeline that can be synchronized with the timestamp obtained from input sensor **1110**.

[**0064**] In order to identify the selected fingertip from an image, processing means **1130** includes pattern recognition software algorithm to recognize the shape of part of the hand that was imaged. Based on this shape and its relative position to the known location of input sensor **1110** (or the contact point when input sensor **1110** is large) in image **1200**, the pattern recognition software algorithm recognizes which fingertip activated input sensor **1110**. For instance, as it is shown in **FIG. 12**, image **1200** contains index finger **513**, part of the proximal phalange of thumb **512**, part of the proximal phalange of middle finger **514** and part of the proximal phalange of index finger **515**. Based on the shape of these different fingers and relative position of these different fingers to the known position of input sensor **520** (or the location of the contact point of selected fingertip **513-FT** with input sensor **520**, when input sensor **520** is large) in image **1200**, pattern recognition software algorithm would be able to recognize that fingertip **513-FT** of index

finger **513** has activated input sensor **520**. As a person of average skill in the art to which this invention pertains would readily appreciate, the amount of information in an image like image **1200** could vary dependent on the abilities of the pattern recognition software algorithm and total number of fingertips that are involved in the particular application (i.e. the fewer fingertips that are defined in correspondence to functions and/or motions, the less information is needed from image **1200** and the smaller image **1200** could be).

[**0065**] From image **1200** pattern recognition software algorithm could for instance recognize the nail on index finger **513** to determine that the dorsal site of the hand is shown in image **1200**. Pattern recognition software algorithm could then recognize that four fingers are present based on the overall width of the image of the part of the hand relative to the width of a typical finger (assuming that the distance to the input sensor or a contact point from or imaging means (image sensor) and thus an average thickness of a user's finger on the image is a known). The pattern recognition algorithm could recognize that the user is contacting input sensor **520** with selected finger **513**, since the contacting or selected finger is always above the known location of input sensor **520** (or the contact point). Furthermore, pattern recognition software algorithm could recognize one finger on the right site of the selected finger and two fingers on the left site of the extended finger. (interpreted from the perspective shown in image **1200**). In addition, pattern recognition software algorithm could recognize that the one finger on the right site of the extended finger is only partially visible indicating that this is the thumb. This information would be enough to identify that the extended finger is the index finger. It would also be possible to have less information in image **1200** in case only the index and middle finger are defined with respect to a function. In this case of only the index and middle finger, an image showing the thumb, index finger and middle finger would be sufficient. As a person of average skill in the art to which this invention pertains would readily appreciate, different kinds of intelligent rules or techniques could be applied to identify the selected fingertip, such as, for instance, but not limited to, supervised learning algorithms such as neural networks or support vector machines, fuzzy rules, probabilistic reasoning, any type of heuristic approaches or rules, or the like.

[**0066**] It would also be possible for processing means **1130** to include a database of stored images that contain different possible finger and fingertip orientations. These images can then be used as a map and comparison for the acquired image. In this case, processing means **1130** also includes software algorithms (which are known in the art) that are able to do contour mapping, least square analyses, or the like to determine whether one of the stored maps fits the shape of the obtained image.

[**0067**] In case motion is defined with respect to a function, the electrical (e.g. resistive) changes as a function of time during the motion of the selected finger over input sensor **1110** need to be interpreted. Therefore, processing means **1130** could also include software algorithms, which are known in the applications for personal digital assistants, to interpret the coordinates, scalar and vector components of the acquired motion. Furthermore, processing means **1130** would include pattern recognition software algorithms to identify the stroke or motion.