

## SYSTEM AND METHOD FOR SELECTING ACTIONS BASED ON THE IDENTIFICATION OF USER'S FINGERS

### CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is cross-referenced to and claims priority from U.S. Provisional application No. 60/313,083 filed Aug. 17, 2001, which is hereby incorporated by reference.

### FIELD OF THE INVENTION

[0002] This invention relates generally to input devices. More particularly, the present invention relates to systems for selecting actions or communicating intents based on the identification of user's fingers through imaging.

### BACKGROUND

[0003] Input devices that allow a user to select an action are well known in the art and can take different forms. Examples of input devices are, for instance, a keyboard, a mouse, a touch sensor pad or panel, a switch, a button, or the like. A user pressing a key on the keyboard, clicking a clicker on a mouse, touching a sensor pad, flipping a switch or pushing a button, could for instance establish activation of the input device and trigger an action. The various kinds of input devices are used for different types of applications such as entering data in a computer-related system, operating a remote control, handling a personal data assistant, operating an audio-visual device, operating an instrument panel, which are merely examples of the different types of applications where input devices or sensors are used.

[0004] One of the main problems in the art of input devices or sensors is the issue of increasing functionality and improving user-friendliness while minimizing the size of the input device. In general, the current input devices could be distinguished into two categories. The first category relates to input devices whereby the action is independent from what actually caused the activation of the input device. The second category relates to input devices whereby the action is dependent from what actually caused the activation of the input device.

[0005] An example of the first category of input devices could be illustrated through the use of a keyboard. If a user wants to select the letter "d" on a keyboard, then the user could activate the letter "d" with any finger of his/her left or right hand, or with any other object or device that can isolate the "d" key from the other keys and activate or press the "d" key. In other words, it does not matter what actually activates the "d" key. Therefore the action of any key on a keyboard is categorized as being independent from what actually caused the action of that particular key. Furthermore, each key on a keyboard is related to one action or function. As a person of average skill in the art would readily appreciate, this example merely illustrates the concept of the first category of input devices and this concept also applies to other input devices, such as a virtual keyboard, a mouse, switch, button, touchpad, touchscreen or the like.

[0006] Korth in U.S. Pat. No. 5,767,842 teaches the use of a virtual keyboard instead of a physical keyboard. In Korth, the movements of a user's fingers are interpreted as opera-

tions on a non-existent virtual keyboard. An image data acquisition system is used for monitoring positions of the user's fingers with respect to the virtual keys on the virtual keyboard. The monitored positions of the fingers of the user's hand operating the virtual keyboard are then correlated to the corresponding key locations on the virtual keyboard. In case of a virtual keyboard, the "d" key is only existent in the virtual sense as a virtual "d" key. Therefore, also for Korth's virtual keyboard, it does not matter what actually activates the virtual "d" key and the action of a key on a virtual keyboard is also categorized as being independent from what caused the action of that particular virtual key.

[0007] One way of increasing the functionality of a key on any type of keyboard is to use an alternative key in combination with the "d" key. For instance, one could use the "shift" key in addition to the "d" key to produce capital letter "D". For a keyboard or similar input device to increase the number of actions or functions, the number of combinations of keys needs to increase or the size of a keyboard needs to increase which both would result in an input device that is impractical. On the other hand it would be possible to decrease the size of the keypads, however, this would also be impractical since the user's fingers might be getting too big in order to discriminate one particular key. However, in all such solutions, the action of a key, whether there are a lot of combinations, a lot of keys or there are a lot of keys in a small space, would still be categorized as being independent from what caused the action of that particular key.

[0008] Another method to increase the functionality of an input device is taught in cell phones. Cell phones teach one solution to maximize the number actions using a key that is capable of generating different actions. A single key on a cell phone would normally be associated with four different actions. For instance, such a key could have one number, such as "3" and three different letters, such as "D", "E", and "F". The activation of "D" is based on one touch on the key, "E" is based on two touches on the key, "F" is based on three touches on the key and "3" is based on four touches on the key. However, as a person of average skill would readily acknowledge, such input devices are user-unfriendly since it requires a lot of effort to generate a word like for instance "Cell Phone".

[0009] Bisset et al. in U.S. Pat. No. 5,825,352 teaches the use of multiple fingers for emulating mouse button and mouse operations on a touch sensor pad. The sensor pad senses the proximity of multiple simultaneous fingers or other appropriate objects to the touch sensors. Bisset et al. teaches that their invention can be described in most of its applications by establishing one finger as controlling movement of the cursor, and the second finger as controlling functions equivalent to a mouse button or switch. In this context according to Bisset et al., one finger may be considered the point finger, while the other finger is the click finger.

[0010] Although, the method taught by Bisset et al. teaches the possibility of using one sensor pad to generate multiple actions using a combination of fingers or objects, there is absolutely no correlation between the combination of fingers or objects and the following action. For instance, the two fingers in Bisset et al. could be an index finger and thumb. However, the two fingers could also be an index