

any modifier symbols being held down by the opposite hand. Step **812** records the time the key symbol is sent for future reference by decision diamond **808**. Processing then returns to step **770** to await the next proximity image scan.

[**0293**] Until the finger lifts off or another taps asynchronously, processing will pass through decision diamond **798** to check whether the key symbol should be sent again. Step **806** computes the symbol repeat interval dynamically to be inversely proportional to finger proximity. Thus the key will repeat faster as the finger is pressed on the surface harder or a larger part of the fingertip touches the surface. This also reduces the chance that the user will cause more repeats than intended since as finger proximity begins to drop during liftoff the repeat interval becomes much longer. Decision diamond **808** checks whether the dynamic repeat interval since the last typematic symbol send has elapsed, and if necessary sends the symbol again in **810** and updates the typematic send time stamp **812**.

[**0294**] It is desirable to let the users rest the other fingers back onto the surface after typematic has initiated **804** and while typematic continues, but the user must do so without tapping. Decision diamond **805** causes typematic to be canceled and the typematic element deleted **778** if the user asynchronously taps another finger on the surface as if trying to hit another key. If this does not occur, decision diamond **182** will eventually cause deletion of the typematic element when its finger lifts off.

[**0295**] The typing recognition process described above thus allows the multi-touch surface to ergonomically emulate both the typing and hand resting capabilities of a standard mechanical keyboard. Crisp taps or impulsive presses on the surface generate key symbols as soon as the finger is released or decision diamond **792** verifies the impulse has peaked, ensuring prompt feedback to the user. Fingers intended to rest on the surface generate no keys as long as they are members of a synchronized finger press or release subset or are placed on the surface gently and remain there along with other fingers for a second or two. Once resting, fingers can be lifted and tapped or impulsively pressed on the surface to generate key symbols without having to lift other resting fingers. Typematic is initiated either by impulsively pressing and maintaining distinguishable force on a key, or by holding a finger on a key while other fingers on the hand are lifted. Glancing motions of single fingers as they tap key regions are easily tolerated since most cursor manipulation must be initiated by synchronized slides of two or more fingers.

[**0296**] Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

What is claimed is:

1. An apparatus comprising the elements of:

- a. a surface comprising a plurality of proximity sensors;
- b. segmentation circuitry for evaluating indications of said proximity sensors and for segmenting said indications into a plurality of groups, each of said groups representing a part of a hand;

- c. identification circuitry for associating each of a plurality of said groups with a specific part of a hand;

- d. tracking circuitry for determining, relative to said surface, a path of each hand part over elapsed time.

2. The apparatus of claim 1 wherein said segmentation circuitry comprises hardware and software.

3. The apparatus of claim 1 wherein said indication of said proximity sensors are one or more image pixels.

4. The apparatus of claim 1 wherein said indications of said proximity sensors comprise a part of a proximity image.

5. The apparatus of claim 4 wherein said part of a proximity image is a whole proximity image.

6. The apparatus of claim 1 wherein one of said groups represents a part of a hand that is a finger and another of said groups represents a part of a hand that is a palm.

7. The apparatus of claim 1 where identification circuitry comprises hardware and software.

8. The apparatus of claim 1 wherein tracking circuitry comprises hardware and software.

9. The apparatus of claim 1 further comprising a pen grip detector for evaluating representations of said groups to determine if said surface is proximate to a hand in the position of gripping a pen.

10. The apparatus of claim 9 wherein said representations of said groups are said specific parts of a hand.

11. The apparatus of claim 9 where said pen grip detector is further for generating signals associated with the perceived movement of said hand in the position of gripping a pen.

12. An apparatus comprising the elements of:

- e. a surface comprising a plurality of sensors, each sensor adapted to sense proximity of an object;

- f. a segmentation unit for evaluating indications of said sensors and for segmenting said indications into a plurality of groups, each of said groups representing a part of a hand;

- g. an identification unit for associating each of a plurality of said groups with a specific part of a hand;

- h. a tracking unit for determining, relative to said surface, a path of each hand part over elapsed time.

13. The apparatus of claim 12 wherein said segmentation unit comprises either hardware or software or both hardware and software.

14. The apparatus of claim 12 wherein said segmentation unit comprises software and a processor.

15. The apparatus of claim 12 wherein said indication of said sensors are one or more image pixels.

16. The apparatus of claim 12 wherein said indications of said sensors comprise a part of a proximity image.

17. The apparatus of claim 16 wherein said part of a proximity image is a whole proximity image.

18. The apparatus of claim 12 wherein one of said groups represents a part of a hand that is a finger and another of said groups represents a part of a hand that is a palm.

19. The apparatus of claim 12 where said identification unit comprises hardware or software or a combination of hardware and software.

20. The apparatus of claim 12 wherein said identification unit comprises software and a processor.

21. The apparatus of claim 12 wherein said tracking unit comprises hardware and software.