checks the impulsivity of the proximity profile for how quickly the finger proximity peaks. If the proximity profile increases to its peak very slowly over time, no key will be generated. This allows the user to gently set down a raised finger without generating a key in case the user lifts the finger with the intention of generating a key but then changes his mind. If the touch surface is compressible, decision diamond **792** can more directly infer finger force from the ratio of measured fingertip proximity to ellipse axis lengths. Then it can threshold the inferred force to distinguish deliberate key presses from gentle finger rests. Since when intending to generate a key the user will normally press down on the new key region quickly after lifting off the old key region, the impulsivity and force thresholds should increase with the time since the finger lifted off the surface.

[0291] Emulating typematic on a multi-touch surface presents special problems if finger resting force cannot be distinguished reliably from sustained holding force on a key region. In this case, the special touch timing sequence detected by the steps of FIG. **43**B supports reliable typematic emulation. Assuming decision diamond **798** finds that typematic has not started yet, decision diamond **794** checks whether the keypress queue element being processed represents the most recent finger touchdown on the surface. If any finger touchdowns have followed the touchdown represented by this element, typematic can never start from this queue element. Instead, decision diamond **796** checks whether the element's finger has been touching longer than the normal tap timeout. If the finger has been touching too long, step **778** should delete its keypress element because decision diamond **786** has determined it is not a modifier and decision diamond **794** has determined it can never start typematic. If decision diamond **794** determines that the keypress element does not represent the most recent touchdown, yet decision diamond **796** indicates the element has not exceeded the tap timeout, processing returns to step **770** to await either liftoff or timeout in a future sensor array scan. This allows finger taps to overlap in the sense that a new key region can be pressed by a finger before another finger lifts off the previous key region. However, either the press times or release times of such a pair of overlapping finger taps must be asynchronous to prevent the pair from being considered a chord tap.

[0292] Assuming the finger touchdown is the most recent, decision diamond **800** checks whether the finger has been touching for a typematic hold setup interval of between about half a second and a second. If not, processing returns to **770** to await either finger liftoff or the hold setup condition to be met during future scans of the sensor array. When the hold setup condition is met, decision diamond **802** checks whether all other fingers on the hand of the given finger keypress lifted off the surface more than a half second ago. If they did, step **804** will initialize typematic for the given keypress element. The combination of decision diamonds **800** and **802** allow the user to have other fingers of the hand to be resting on the surface when a finger intended for typematic touches down. But typematic will not start unless the other fingers lift off the surface within half a second of the desired typematic finger's touchdown, and typematic will also not start until the typematic finger has a continued to touch the surface for at least half a second after the others lifted off the surface. If these stringent conditions are not met, the keypress element will not start typematic and will eventually be deleted through either tap timeout **782** when the finger lifts off or through tap timeout **796**) if another touches down after it.

[0293] Step **804** simply sets a flag which will indicate to decision diamond **798** during future scan cycles that typematic has already started for the element. Upon typematic initialization, step **810** sends out the key symbol for the first time to the host interface communication queue, along with 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.

[0294] 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**.

[0295] 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.

[0296] 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 ether 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.

[0297] 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

a. a power source;

b. a sense measurement element;

c. a plurality of sensors, each sensor capable of detecting a nearby object, and each sensor having an input and an output;