relatively large touch-sensitive surface, which can significantly increase the expense of creating a handheld device.

[0012] Therefore, the need exists for a new method of text entry for handheld and wearable devices that provides greater accuracy and stability of motion.

SUMMARY OF THE INVENTION

[0013] The present invention is a new unistroke text entry method for handheld and wearable devices designed to provide high accuracy and stability of motion. The user makes characters by traversing the edges and diagonals of a shape (e.g., a square) imposed over the usual text input area. The present invention employs a high percentage of strokes in the four cardinal directions. But unlike other unistroke techniques, the present invention is not a pattern recognizer, and does not depend on the whole path of the character for recognition. Thus, moderate wiggle (e.g., caused by hand tremor) in the stroke does not deter high recognition rates.

[0014] The present invention improves the quality of text entry using physical edges. Physical edges offer many desirable properties. Applying pressure against an edge while entering a character provides greater stability (decreased movement variability and movement offset), greater speed (the ability to move quickly yet remain on the target line), higher accuracy (targets along an edge or in a corner are easier to acquire), and tangible feedback (no longer is visual feedback the only means of self-correction during movement, as tactile feedback is available).

[0015] This invention exploits these benefits of edges in a text entry technique, and avoids other factors such as cognitive or mnemonic difficulties. We call this input technique EdgeWrite. It relies heavily on edges and corners, both interactively and algorithmically.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] For the present invention to be easily understood and readily practiced, preferred embodiments will now be described, for purposes of illustration and not limitation, in which:

[0017] **FIG. 1** is the preferred embodiment of the invention on a PDA with a template with a square hole.

[0018] **FIG. 2** is an example character chart showing one form of each of the characters using the present invention.

[0019] **FIG. 3** is another embodiment of the invention as a joystick in a square mounting area.

[0020] **FIG. 4** is another embodiment of the invention as a joystick mounted on a game controller.

[0021] **FIG. 5** is another embodiment of the invention as a joystick mounted on a mobile phone.

[0022] **FIG. 6** shows how the corner areas are implemented in the preferred embodiment on a PDA.

[0023] **FIG. 7** shows another embodiment on a wrist watch.

[0024] **FIG. 8** shows another embodiment on a touch pad, which uses a finger in place of a stylus.

[0025] **FIG. 9** is a flow chart summarizing one embodiment of a recognition algorithm.

DETAILED DESCRIPTION OF THE INVENTION

[0026] **FIG. 1** shows one embodiment of the present invention where these edges are imposed on the text entry area of a PDA by means of a transparent plastic template **103** with, in this embodiment, a square hole **104**. All text entry is performed inside this hole. Our experimental results show that extensive iteration of the character set has made the character forms highly guessable and easy to learn, maintaining a low cognitive workload for the user.

[0027] In particular, we found that when compared to Graffiti, the present invention was 18% more accurate during text entry for able-bodied users formerly unfamiliar with either technique. This benefit came without a significant cost in speed. Users with motor impairments (such as Parkinson's, Cerebral Palsy, and Muscular Dystrophy) succeeded at using the present invention but were largely unable to use Graffiti.

[0028] The present invention can be used as a stylus-based unistroke input technique. To make a character, the user places the stylus **105** down inside the square hole **104** (**FIG. 1**), moves the stylus in a specific pattern along edges and diagonals into corners of the square, and lifts upon completion of the character. A processor **107** is responsive to the input and to a memory **108** which carries software for implementing the character recognition method of the present invention.

[0029] One difference between the preferred embodiment of the present invention and gestural techniques like Graffiti is that all stylus motion in the present invention occurs within a confined geometric shape, for example, a small plastic square hole that, in the preferred embodiment, is 1.3 cm on a side (1.69 cm^2). This square hole bounds the input area with firm physical edges.

[0030] A second difference between the present invention and gestural techniques like Graffiti is that recognition does not depend on the path of movement, nor is the recognizer a pattern matcher. Instead, recognition only depends on the order in which the corners are hit. The advantages of this include:

- [0031] Users can "wiggle" or slide in moderation and this does not degrade recognition.
- [0032] The recognition algorithm is elegant and fast, as hit-testing corner areas is an operation capable of being performed rapidly even by a weak processor.
- [0033] Users can teach the system their own custom gestures with one example, as training sets for a pattern matching algorithm are not necessary.
- [0034] From a design standpoint, it is easy to iterate character forms, as changing them requires changing only a corner sequence value. No sets of ideal points or paths are necessary.

[0035] A third difference between the present invention and Graffiti is the reduction of modes. In particular, the present invention uses no shift, caps lock, or extended shift modes. The only mode in the present invention is a punctuation mode (which is not required for a period, as it is such a common character).