

METHOD AND DEVICE FOR CONTROLLING DISPLAY OF CHARACTERS

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Field of the Invention

This invention relates to a method and device for varying widths of characters for displaying on low resolution displays. This invention is particularly useful for, but not necessarily limited to, varying the width of characters on low resolution displays associated with portable electronic devices such as pagers or personal diaries that have limited processing power.

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Background of the Invention

A display for an electronic device is typically a pixel matrix of discrete elements such as liquid crystals or light emitting diodes. Characters to be displayed on the display are formed by selectively activating, or inactivating, pixels within the pixel matrix. Data for such characters is typically stored in a memory within the electronic device.

To decrease size and cost, some portable electronic devices have small displays with low resolution for displaying characters. Minimizing a number of pixels to display each character allows for more characters to be shown at the same time on low resolution displays. However, a drawback in such low resolution displays is that the small characters displayed are not easily readable. Enlarging, for example, to widen the small characters to improve clarity with conventional techniques requires computational overheads such as a character generating read-only-memory storing different sizes of characters. Also, these overheads are not ideally suitable for portable electronic devices such as pagers or electronic diaries. Furthermore, on such low resolution displays, conventional techniques may distort the small characters upon widening which may not be acceptable to purchasers.

Summary of the Invention

It is an object of this invention to overcome or at least alleviate at least one of the problems associated with varying the width of characters
5 displayed on a low resolution display.

According to one aspect of the invention, there is provided an electronic device comprising:

display means for displaying at least one character, said character comprising activated and inactivated pixels forming two peripheral
10 columns with a plurality of intermediate columns therebetween; and
processing means, coupled to said display means, for controlling said displaying to thereby insert one or more replicas of at least one of said intermediate columns, one of said replicas being inserted adjacent an original thereof to thereby widen said character without
15 widening said peripheral columns.

Suitably, said pixels can be electronically activatable liquid crystals or light emitting diodes.

20 Preferably, said processing means can be adapted to replicate all said intermediate columns.

Alternatively, said processing means can be adapted to replicate said intermediate columns having both activated and inactivated pixels.
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Preferably, said processing means can be adapted to receive a column replication factor for indicating number of replicas to replicate.

Suitably, said processing means can be adapted to increase a height
30 of said character.

According to another aspect of the invention, there is provided a method for controlling display of at least one character, said character having activated and inactivated pixels forming, on a display, two
35 peripheral columns with a plurality of intermediate columns therebetween, said method comprising the steps of:

(i) replicating at least one of said intermediate columns to thereby

- derive one or more replicas; and
- (ii) inserting said replicas into said display to thereby widen said character, one of said replicas being inserted adjacent to an original thereof without widening said peripheral columns.

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Suitably, said step of (i) replicating can comprise the step of receiving a column replication factor for indicating number of replicas to replicate said intermediate columns.

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Preferably, said step of (i) replicating can comprise the step of replicating all said intermediate columns.

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Alternatively, said step of (i) replicating can comprise the step of replicating said intermediate columns having both activated and inactivated pixels.

Suitably, said method can further comprise the step of increasing a height of said character.

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Brief Description of the Drawings

In order to describe the invention and to put it into practical effect, reference will now be made to preferred embodiments as illustrated with reference to the accompanying drawings in which:

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FIG. 1 shows a functional block diagram of an electronic device having a display and a processor in accordance with a preferred embodiment of the invention;

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FIG. 2 shows characters displayed on the display of FIG. 1 in accordance with the preferred embodiment of the invention;

FIGs. 3 and 4 show the characters of FIG. 2 widened in accordance with the preferred embodiment of the invention;

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FIG. 5 shows the characters of FIG. 2 widened and increased in height in accordance with the preferred embodiment of the invention;

FIGs. 6a and 6b shows character "T" of FIG. 2 widened in accordance with an alternative embodiment of the invention; and

FIG. 7 shows a method for displaying at least one character in accordance with the embodiments of the invention.

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Detailed Description of the Invention

FIG. 1 shows a functional block diagram of an electronic device 100, such as a selective call receiver, in accordance with a preferred embodiment of the invention. Display means for the electronic device 100 comprises a display 102 for displaying characters. Processing means for the electronic device 100 comprises a processor 104, coupled to the display 102, for controlling the displaying.

20 In accordance with the preferred embodiment of the invention, FIG. 2 shows examples of the characters displayed in the display 102. A pixel column 202 and a pixel 206 are indicated in FIG. 2. Characters "A", "T" and "Z" are used as examples for purposes of illustrating this invention. Each of the characters comprises activated and inactivated pixels forming two peripheral columns 210 with a plurality of intermediate columns 208. Character "T" has a center intermediate column 212 with only activated pixels whereas all other intermediate columns 208 in FIG. 2 have both activated and inactivated pixels.

30 In controlling the displaying, the processor 104 replicates and inserts replicas of the intermediate columns 208 to thereby widen the characters. Widths of the two peripheral columns are maintained and not widened by replicating. In the controlling, one of the replicas is inserted adjacent to an original intermediate column 208. In the preferred embodiment of the invention, the processor 104 is adapted to replicate all intermediate columns 208 of the characters without widening the intermediate columns

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208. A column replication factor, received by the processor 104, indicates number of replicas to replicate the original intermediate column 208.

FIGs. 3 and 4 show the characters of FIG. 2 widened in accordance with the preferred embodiment of the invention. In FIG. 3, the column replication factor has a degree of two. Hence, the intermediate columns 208 for the characters of FIG. 2 are replicated by the degree of two such that each of the characters is now widen from three intermediate columns 208 to six intermediate columns 208. The two peripheral columns 210 are not widened and each is maintained at one pixel column in width. In FIG. 4, the column replication factor has a degree of three resulting in the intermediate columns 208 being widened to nine intermediate columns 208.

In accordance with the preferred embodiment of the invention, the processor 104 is also adapted to replicate the intermediate columns 208 and the two peripheral columns 210 to increase a height of the characters, as shown in FIG. 5. In FIG. 5, the characters have been processed with a height and a column replication factor both with a degree of two.

In accordance with an alternative embodiment of the invention, only intermediate columns 208 of the characters having both activated and inactivated pixels are replicated. FIGs. 6a and 6b show character "T" of FIG. 2 widened in accordance with the alternative embodiment of the invention. In the alternative embodiment, a center intermediate column 212 of the characters, having either only activated pixels or only inactivated pixels, is not replicated. For example, the character "T" is widened with a column replication factor with a degree of two in FIG. 6a and with a degree of three in FIG. 6b. Hence, in the alternative embodiment, only intermediate columns 208 having both activated and inactivated pixels are replicated.

Applied within the electronic device 100, the invention advantageously enables the processor 104 to adequately display the characters for the display 102 upon receiving the column replication factor. A further advantage of the invention is that additional computational overheads, such as a character generating read-only-memory, are not required.

FIG. 7 shows a method 700 for controlling display of the characters in accordance with the embodiments of the invention. The method 700 comprises step 704 of receiving the column replication factor for indicating
5 number of replicas to replicate the intermediate columns 208 of the characters. The method 700 further comprises step 706 of replicating the intermediate columns 208 by the processor 104 based on degree of the column replication factor. Step 706 also comprises maintaining widths of the two peripheral columns 210. Thereafter, in step 708, replicas of the
10 intermediate columns 208 are inserted into the display 102 to thereby widen the characters, one of the replicas being inserted adjacent to an original intermediate column 208.

The method 700 widens the characters depending on the column
15 replication factor. Hence, the processor 104 advantageously provides the display 102 with wider characters that are formatted to improve clarity without requiring additional computational overheads.

Although the invention has been described with reference to preferred
20 embodiments, it is to be understood that the invention is not restricted to any one of the embodiments described herein.

CLAIMS

We claim:

1. An electronic device comprising:
5 display means for displaying at least one character, said character comprising activated and inactivated pixels forming two peripheral columns with a plurality of intermediate columns therebetween; and
processing means, coupled to said display means, for
10 controlling said displaying to thereby insert one or more replicas of at least one of said intermediate columns, one of said replicas being inserted adjacent an original thereof to thereby widen said character without widening said peripheral columns.
- 15 2. The electronic device of Claim 1 wherein said processing means is adapted to replicate said intermediate columns having both activated and inactivated pixels.
- 20 3. The electronic device of Claim 1 wherein said processing means is adapted to receive a column replication factor for indicating number of replicas to replicate.
- 25 4. The electronic device of Claim 1 wherein said processing means is adapted to increase a height of said character.
- 30 5. A method for controlling display of at least one character, said character having activated and inactivated pixels forming, on a display, two peripheral columns with a plurality of intermediate columns therebetween, said method comprising the steps of:
35 (i) replicating, by a processor coupled to said display, at least one of said intermediate columns to thereby derive one or more replicas; and
(ii) inserting said replicas into said display to thereby widen said character, one of said replicas being inserted adjacent to an original thereof without widening said peripheral columns.



6. The method of Claim 5 wherein said step of (i) replicating comprises the step of receiving a column replication factor for indicating number of replicas to replicate.
- 5 7. The method of Claim 5 wherein said step of (i) replicating comprises the step of replicating all said intermediate columns.
8. The method of Claim 5 wherein said step of (i) replicating comprises the step of replicating said intermediate columns having both activated and inactivated pixels.
- 10 9. The method of Claim 5 and further comprising the step of increasing a height of said character.
- 15 10. An electronic device comprising display means and processing means substantially as described herein with reference to and as illustrated by the accompanying drawings.
- 20 11. A method for controlling display means for displaying at least one character substantially as described herein with reference to and as illustrated by the accompanying drawings.

