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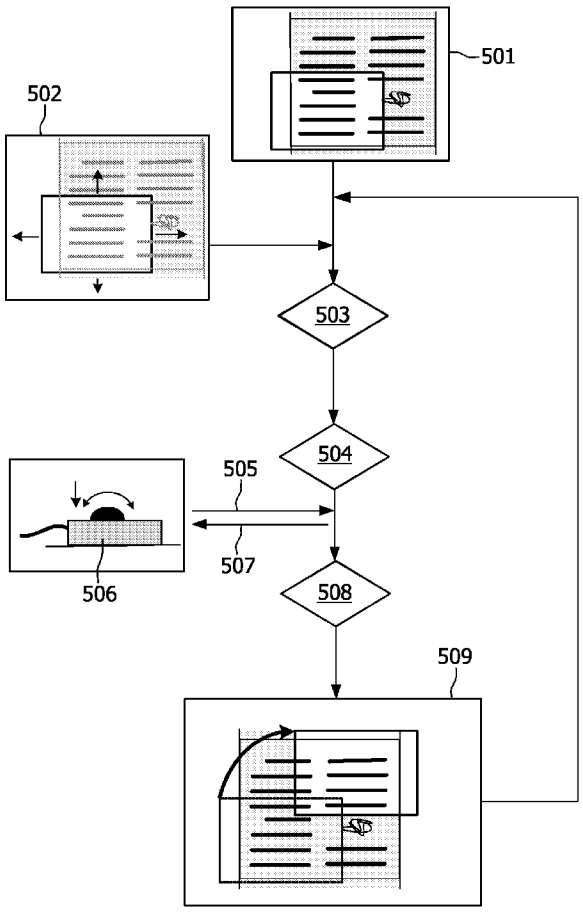
(54) Title: SCROLL METHOD WITH CONTEXTUAL SCROLL RATE AND FEEDBACK



(57) Abstract: The present invention relates to a method and a device for scrolling a document being displayed to a user operating a scroll device, where the scroll rate and/or the scroll direction is determined based on information on the content in and related to the displayed section of the document and based on input from the user. According to the invention the scroll rate and direction can be adapted continuously throughout the scrolling of the document, so that the scrolling adapts to the content related to the section being currently displayed. The method and device according to the present invention furthermore gives the user feedback in terms of varying wobble rates corresponding to the scroll rate and/or direction.

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Scroll method with contextual scroll rate and feedback

The present invention relates to a method and a device for displaying a document to a user operating a scroll device.

When displaying a document to a user e.g. on a computer screen the document seldom fits the display whereby scrolling or some other way of moving the displayed part of the document around on the screen becomes necessary. Scrolling can be performed in many ways such as by pressing the 'page down' button, turning the scroll wheel on a computer mouse, controlling a joystick or using a touch pad.

A document is traditionally scrolled either in a vertical or horizontal direction or in the direction given by the user. The speed by which the scrolling is performed (the scroll rate) is mostly fixed and kept constant throughout the entire document. Even if it is possible to set or change the scroll rate this still remains fixed for the rest of the document or until it is reset by the user again. Scrolling through a blank page requires as much scrolling activity as scrolling through a fully written page or a page fitted with a number of images. Such fixed scrolling behavior, however, often leads to a tedious and tiresome positioning and/or movement of the users hand or fingers. Also, for documents with multiple columns a reader must scroll back up to the top of the next column in order to continue reading; a procedure which is both tiresome and irritating as it breaks the continuity of the reading and the reader's concentration. The same problem arises for other types of documents with blocks of content somehow linked together, but not necessarily placed beneath each other in the correct order, such as an online newspaper, etc.

In US 5850211 is described an eye track-driven scrolling apparatus, where the scroll rate can be gradually changed based on how far down on a screen of text a user has read so that the reader will not run out of text. However, the method is specifically developed to an eye-tracker, which is not a very commonly preferred controlling device and is also a rather costly solution to the problem. Furthermore, the method does still not solve the problem of easily and effortlessly jumping around in a document following the context while scrolling.

It is therefore an object of the present invention to describe a contextual scrolling method solving the above-mentioned problems and which on the same time provides the user with a feedback of the scrolling.

According to the present invention this is obtained by a method for scrolling a document being displayed to a user operating a scroll device, where a section of the document is displayed, and where the method comprises the steps of:

- accessing content information of at least a part of the document, said content information being related to said displayed section,
- receiving input from said scroll device,
- determining a scroll rate based on said content information related to said displayed section and based on said input, and
- using said scroll rate when scrolling said document.

Thereby is obtained that the velocity by which a document is scrolled is adapted to the contents of the part of the document, which is currently being scrolled. Hereby the scroll rate used for lines of text and small images is different than for large images. This enables the user to scroll faster through passages of little information and slower through sections with high information density. Further advantages are mentioned throughout the detailed description.

In an embodiment the above described scrolling method further comprises the steps of continuously accessing the content information of at least a part of the document, where said content information is related to said currently displayed section and updating said scroll rate based on said content information. In this way the scroll rate is continuously adapted to the information density currently being displayed or is about to be displayed.

In a further embodiment the method comprises the steps of determining a scroll direction based on said content information related to said displayed section and based on said input, and using said scroll direction when scrolling said document. Further, in another embodiment of the present invention the method comprises continuously accessing content information of at least a part of the document, said content information being related to said currently displayed section and updating said scroll direction based on said content information. This is advantageous in that it allows the user to scroll through content linked together, but not necessarily placed after each other by simply continuing the scroll movement without having to change the direction. In other words, the scroll can hereby

follow the content and not necessarily the document layout. In this way documents of multiple columns can be read without having to scroll back up to the top of a new column. Similarly, the method can advantageously be used on documents such as online newspapers where one story might very well start on one page and continue on a different page.

In yet another embodiment of the present invention the method according to any of the above further comprises the steps of determining a wobble frequency reflecting said scroll rate, and signaling said wobble frequency to said user via audio, visual or sensual signals. This provides the user with a continuous feedback reflecting how the document is scrolled, whereby the user's control of the process is enhanced.

In a further embodiment the method also comprises the steps of determining a wobble friction or resistance based on said content information related to said displayed section, and signaling said wobble friction or resistance to said user via audio, visual or sensual signals. In the same way as for the wobble frequency, this gives the user a continuous feedback helping the user to effortless scroll through the document without loosing his concentration.

The present invention further relates to a computer-readable medium having stored therein instructions for causing a processing unit to execute a method according to any of the above. The advantages are as described above for the scrolling method.

Also, the present invention concerns a device adapted for scrolling a document being displayed to a user operating a scroll device, where a section of the document is displayed, said device comprising

- means for accessing content information of at least a part of the document, said content information being related to said displayed section,
- an input device for receiving input from said scroll device,
- a processor for determining a scroll rate based on said content information related to said displayed section and based on said input, and
- output means for using said scroll rate when scrolling said document.

In an embodiment the device further comprises a processor determining a scroll direction based on said content information related to said displayed section and based on said input, and output means for using said scroll direction when scrolling said document.

In an embodiment the device further comprises a processor determining a wobble frequency reflecting said scroll rate and a transmitter for transmitting said wobble frequency to said user via audio, visual or sensual signals.

In an embodiment the device further comprises a processor determining a wobble resistance based on said content information related to said displayed section and a transmitter for transmitting said wobble resistance to said user via audio, visual or sensual signals.

In the following preferred embodiments of the invention will be described referring to the Figures, where

- Fig. 1 schematically illustrates scrolling according to prior art,
- Fig. 2 illustrates one embodiment of a scrolling method according to the present invention,
- Fig. 3A-C shows different wobble frequencies and wobble resistance as functions of the scroll movement,
- Fig. 4 illustrates the scrolling of document with multiple columns,
- Fig. 5 shows the scrolling method according to an embodiment of the invention, and
- Fig. 6 shows a device according to the present invention to be used when scrolling a document.

Fig. 1 illustrates how a document 101 is conventionally scrolled through and displayed on e.g. a computer screen. The document 101 in the Figure consists of multiple pages 107 containing different types of content such as text 105 and Figures 106. The velocity by which subsequent sections 102 of the document are shown after each other is here and in the following termed the scroll rate. Subsequent sections 102 of the document are shown after each other typically by moving a slider bar, turning a scroll wheel or by using some other scroll device. The position of the slider bar or the scroll device reflects the placement of the displayed section in the document. In Fig. 1 the scroll movement is illustrated on the vertical line 103 onto which is marked a series of subsequent scroll positions 104 (for example the positions of a slider bar corresponding to equal turns on a scroll wheel) leading to the displaying of the subsequent document sections 102 at equal intervals. Conventionally the scroll rate remains constant and fixed throughout the entire document and the amount of scrolling performed by the user on the scroll device thus corresponds directly to the length of document being scrolled.

In Fig. 2 is illustrated a contextual scrolling method according to one embodiment of the present invention. As in Fig. 1, subsequent scroll positions 104 are sketched on the vertical line 103. As can be seen from the Figure, equal scroll movements do not result in equal scrolling in the document as is the case in most conventional scrolling methods. Instead the scrolling rate depends on the content of the document 101, so that for instance a larger portion of the document is scrolled when scrolling past a Fig. 106 than when scrolling through lines of text 105. In other words, the scroll rate is adapted to the information density or granularity of the present section of the document. Such an information density can for instance be determined as the number of lines per some distance or number of images per page, etc. The system receives information on the content of the document, i.e. text sections, paragraphs, images and their physical sizes, boxes, page breaks, etc. and determines the appropriate scroll rate based on this contextual information. Hereby a user can scroll through a document faster than traditionally where the scroll rate remains fixed and constant. Furthermore, the users comfort when scrolling is enhanced as the displaying of a document fits the contents of the document better.

In another embodiment of the invention the scroll rate depends not on the content of the presently displayed section of the document, but rather on the content to be displayed next. For instance, if a large picture is coming up, then the scroll rate is adapted so that when scrolling the whole picture will be shown in the next display and not only a part of it.

In another embodiment the change from one scroll rate to a second scroll rate of a significant difference may be smoothed in anticipation of the upcoming scroll rate. This gives the user a feeling of the upcoming text structure and it avoids a sudden jump in scroll rate, which might cause him to lose his current reading position.

In yet another embodiment several scroll rates are determined for each displayed section of a document, so that one scroll rate is used when the user is scrolling down and another if the user scrolls up or to a side and so forth.

A scroll device such as the scroll wheel of a computer mouse or a joystick generates a certain wobbling feel when rotated or moved. This gives the user an understanding of the scroll rate. This periodic resistance that a user experiences when rotating the scroll wheel will here and in the following be termed the wobble rate and is defined by a frequency and a resistance strength or friction that needs to be overcome repeatedly when rotating the wheel. The Figs. 3A-C graphically illustrates different wobble rates of a scroll device where the friction is plotted as a function of the movement of the scroll device. The

curve in Fig. 3A illustrates the behavior of a conventional scroll wheel where the frequency 301 (how many wobbles per length) and the strength 302 (the ease with which the wheel is turned) of the wobbles 304 are constant and remain fixed as a function of the rotation of the wheel. The curve in Fig. 3B illustrates a wobble rate according to one embodiment of the invention where the frequency 302 of the wobbles 304 is varying so that a wobble can occur with irregular intervals. According to the present invention the wobble frequency can be correlated to the varying scroll rate of the document, thereby reflecting the contents of the displayed part of the document. For instance, for fine-granular information (like lines of text) a wobble frequency is selected which reflects the rate at which text lines pass through the window broken by longer wobbles for images, at every new paragraph, etc. In this way the user is given a feedback from the system and thus a better feeling and control of the scroll. Similarly, the resistance or friction of the wobbles can be varied and adapted to the content of the document as illustrated by the curve in Fig. 3C. The strength or friction 302 of the wobbles can be increased to indicate an event like for instance reaching the bottom of a page when scrolling, when passing spell errors in a text, etc. The feedback as given by the wobble rate can be given to the user in many different ways; not only by a physical and sensual feedback as for the scroll wheel on a computer mouse, but also by audio or visual signaling such as by a clicking sound, color changes on the screen, etc.

The content dependent scrolling according to this invention can also be used conveniently in conjunction with documents of multiple columns 401, see Fig. 4. Here, instead of the user having to scroll back up to the top of the page to start reading the next column, the contextual scrolling enables the user to just simply continue scrolling while the system then takes care of automatically jumping to the top of the next column. This is illustrated in Fig. 4 where subsequent scroll positions 104 as marked on the vertical line 103 indicating the scroll movement leads to the displaying of subsequent sections 102 towards the bottom of one column 402, 403 on a page 107 of the document 101. If the user continues to scroll, the beginning 404 of the next column will automatically be displayed. In this way, not only the scroll rate is changed based on the contents in the document, but also the scroll direction. The column jump can preferably be combined with an appropriate feedback, for instance in the form of an increased wobble friction informing the user of the change in the scroll direction. Further, if the user wishes to continue to scroll past the page break 405 instead of jumping to the next column, the user can press the scroll wheel down using it like a button, in this way signaling 406 to change the scroll behavior. The signaling action by the

user can of course be given in any other appropriate way; by tilting the wheel to the left/right, by pressing a button, by not pressing a button, by making a sound, etc.

Analogue to the above described multi-column scroll, the scroll method can be used advantageously to scroll documents containing blocks of information where the blocks are linked or grouped together, but not necessarily placed after each other. As for instance the case with newspapers where a page is typically build up by a lot of blocks. First, each block can contain multiple columns making the above- mentioned multi-column scroll favorable. Secondly, often one block on say page 1 is continued on say page 6. In this case this information could be used by an embodiment of the invention so that a continuous scroll by the user would lead to a scroll through the relevant story independent of where the story is physically placed in the document. To improve the user control of the scrolling and handling of the document feedback could be given by, for instance, increasing the wobble resistance or friction at column and page breaks. Another example of a document where the proposed scrolling method would facilitate the navigation is big and complex drawings like for instance floor plans where the scrolling rate could be determined on a hierarchy built up by e.g. lines, rooms, floors, etc. and the scroll direction adapted to perform a continuous scroll from room to room for instance. Other examples of documents where the proposed method could be applied are Electronic Programming Guides and spreadsheets.

The scrolling method according to one embodiment of the invention is illustrated in Fig. 5. Typically, a first section of a document is displayed 501 and information is accessed on the content of at least a part of the document related to this first section 502. The scroll rate and the scroll direction are then determined in step 503 based on this information. If feedback of the scroll is to be given to the user then the wobble frequency and wobble resistance or friction are determined in step 504 reflecting the scroll behavior and thus indirectly the content of the document. Upon receiving input 505 from the user controlled scroll device 506, which on the same time feedbacks 507 as determined by the wobble rate, the position of the new section to be displayed is determined in step 508 and finally displayed in step 509. Content information regarding the new section is then accessed 502, and the scroll rate and direction and the wobble rate are then adapted correspondingly in steps 503, 504.

Fig. 6 shows a device 601 for scrolling a document according to the invention comprising an input device 602, means for accessing content information on the document being displayed 603, two processors P_1 and P_2, 604 and 605, respectively and a transmitter 606. Information related to the parts of the document currently being displayed

607 is accessed by an accessing device 603 for instance by reading from where the information is stored or by receiving the information from another part of the system. A user 608 operates scroll device 506, which sends input 505 to an input device 602. Based on this input and the content information a processor P_1 604 determines an appropriate scroll rate and/or direction. The device uses this scroll rate and/or direction to determine the corresponding wobble rate in the processor P_2 605 which is then transmitted via a transmitter 606 as feedback 507 to the user 608. The signaling can apply any form of acoustic signals, visual effects or sensual (physical) effect.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word 'comprising' does not exclude the presence of other elements or steps than those listed in a claim. The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In a device claim enumerating several means, several of these means can be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

CLAIMS:

1. A method for scrolling a document (101) being displayed to a user (608) operating a scroll device (506), where a section (102) of the document is displayed, said method comprising the steps of

- accessing content information (502) of at least a part of the document (101), said content information being related to said displayed section (102),
- receiving input (505) from said scroll device (506),
- determining a scroll rate (503) based on said content information (502) related to said displayed section (102) and based on said input (505), and
- using said scroll rate when scrolling said document (509).

2 A method according to claim 1, further comprising the steps of

- continuously accessing content information (502) of at least a part of the document, said content information being related to said currently displayed section (102), and
- updating said scroll rate (503) based on said content information.

3. A method according to any of the claims 1-2, further comprising the steps of

- determining a scroll direction (503) based on said content information related to said displayed section and based on said input, and
- using said scroll direction when scrolling said document.

4. A method according to any of the claims 1-3, further comprising the steps of

- continuously accessing content information of at least a part of the document, said content information being related to said currently displayed section, and
- updating said scroll direction based on said content information.

5. A method according to any of the claims 1-4, further comprising the steps of

- determining a wobble frequency (301) reflecting said scroll rate, and

- signaling said wobble frequency (301) to said user via audio, visual or sensual signals (507).

6. A method according to any of the claims 1-5, further comprising the steps of
- determining a wobble resistance (302) based on said content information related to said displayed section, and
- signaling said wobble resistance (302) to said user via audio, visual or sensual signals.

7. A computer-readable medium having stored therein instructions for causing a processing unit to execute a method according to claims 1-6.

8. A device (601) adapted for scrolling a document (101) being displayed to a user (608) operating a scroll device (506), where a section (102) of the document is displayed, said device comprising
- means for accessing (603) content information (502) of at least a part of the document, said content information being related to said displayed section (102),
- an input device (602) for receiving input (505) from said scroll device (506),
- a processor (604) for determining a scroll rate based on said content information (502) related to said displayed section (102) and based on said input (505), and
- output means for using said scroll rate when scrolling said document.

9. A device adapted for scrolling a document according to claim 8 further comprising
- a processor (604) determining a scroll direction based on said content information (502) related to said displayed section (102) and based on said input (505), and
- output means for using said scroll direction when scrolling said document.

10. A device adapted for scrolling a document according to any of the claims 8-9 further comprising
- a processor (605) determining a wobble frequency (301) reflecting said scroll rate, and
- a transmitter (606) for transmitting said wobble frequency (301) to said user via audio, visual or sensual signals (507).

11. A device adapted for scrolling a document according to any of the claims 8-10 further comprising

- a processor (605) determining a wobble resistance (302) based on said content information related to said displayed section, and
- a transmitter (606) for transmitting said wobble resistance (302) to said user via audio, visual or sensual signals (507).

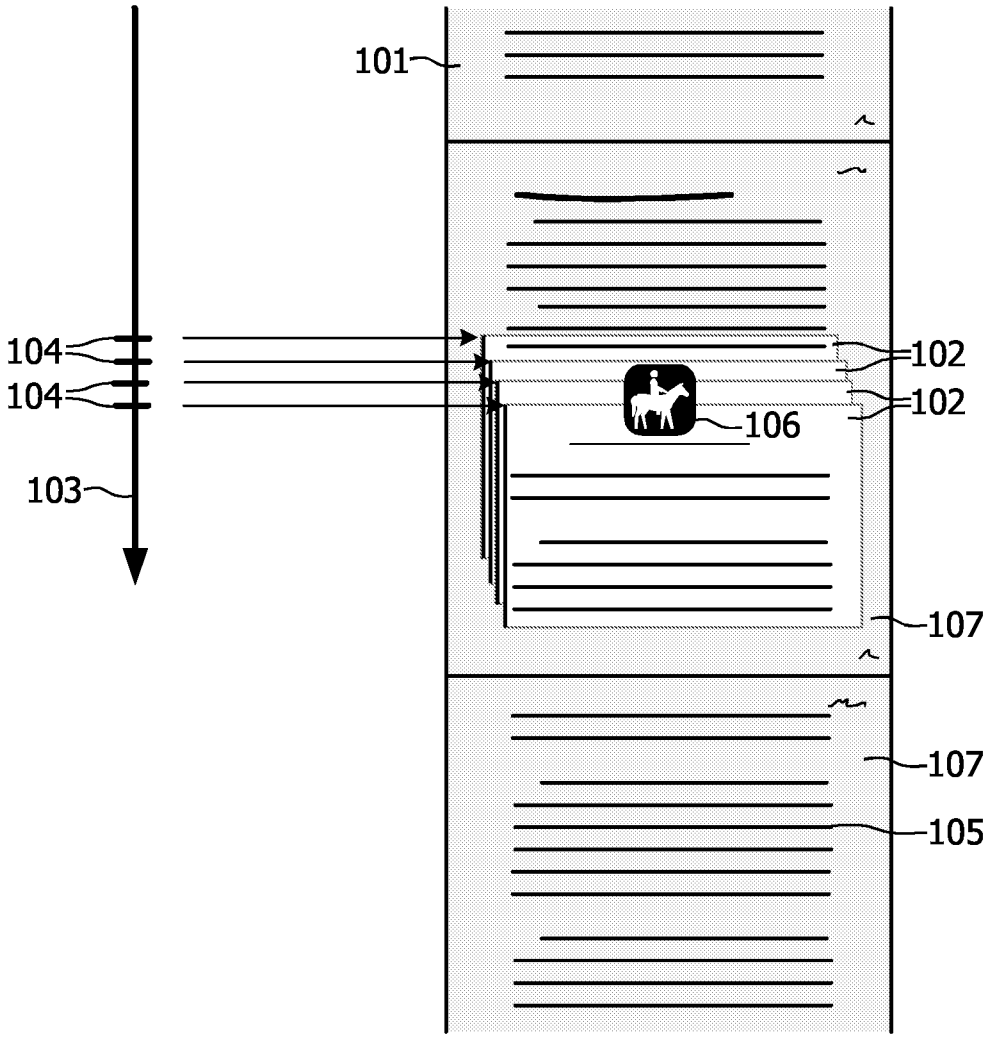

FIG. 1 prior art

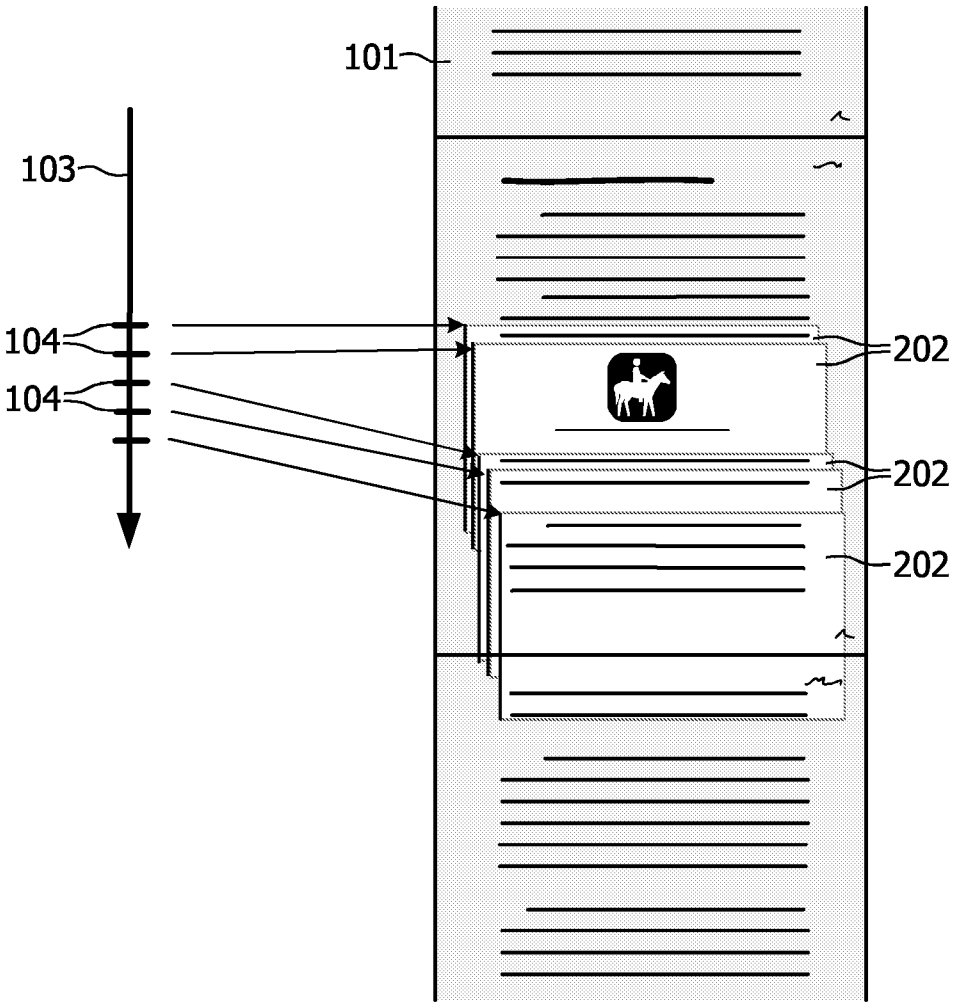

FIG. 2

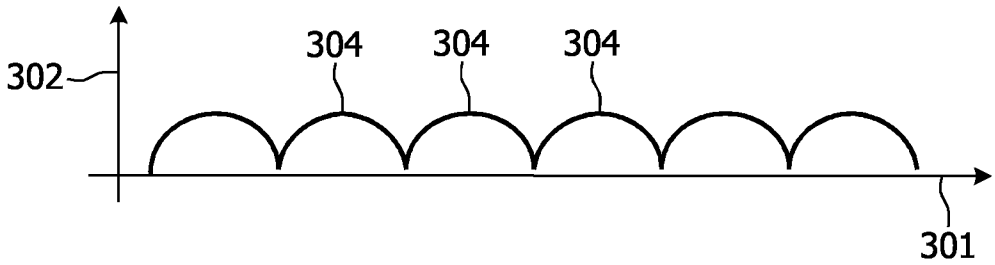

FIG. 3A

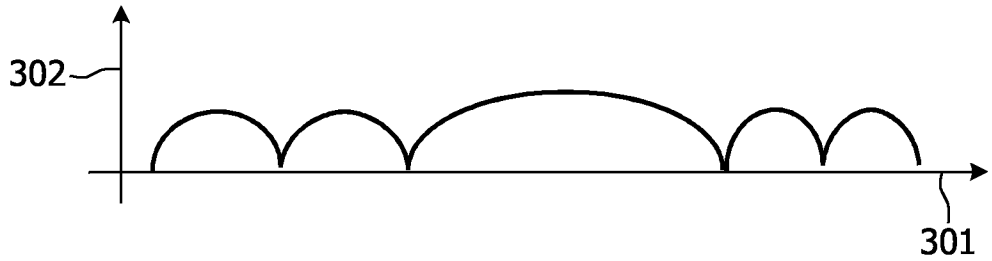

FIG. 3B

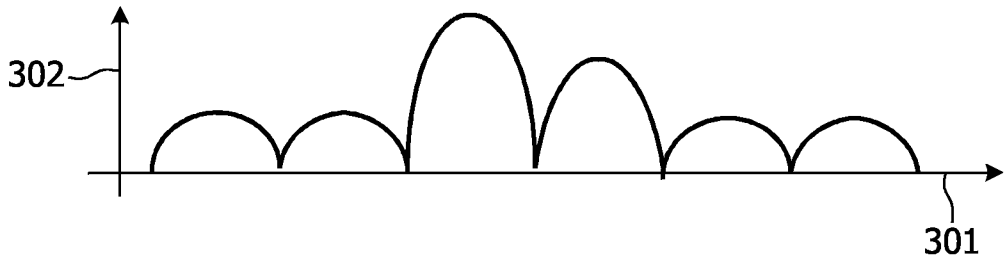

FIG. 3C

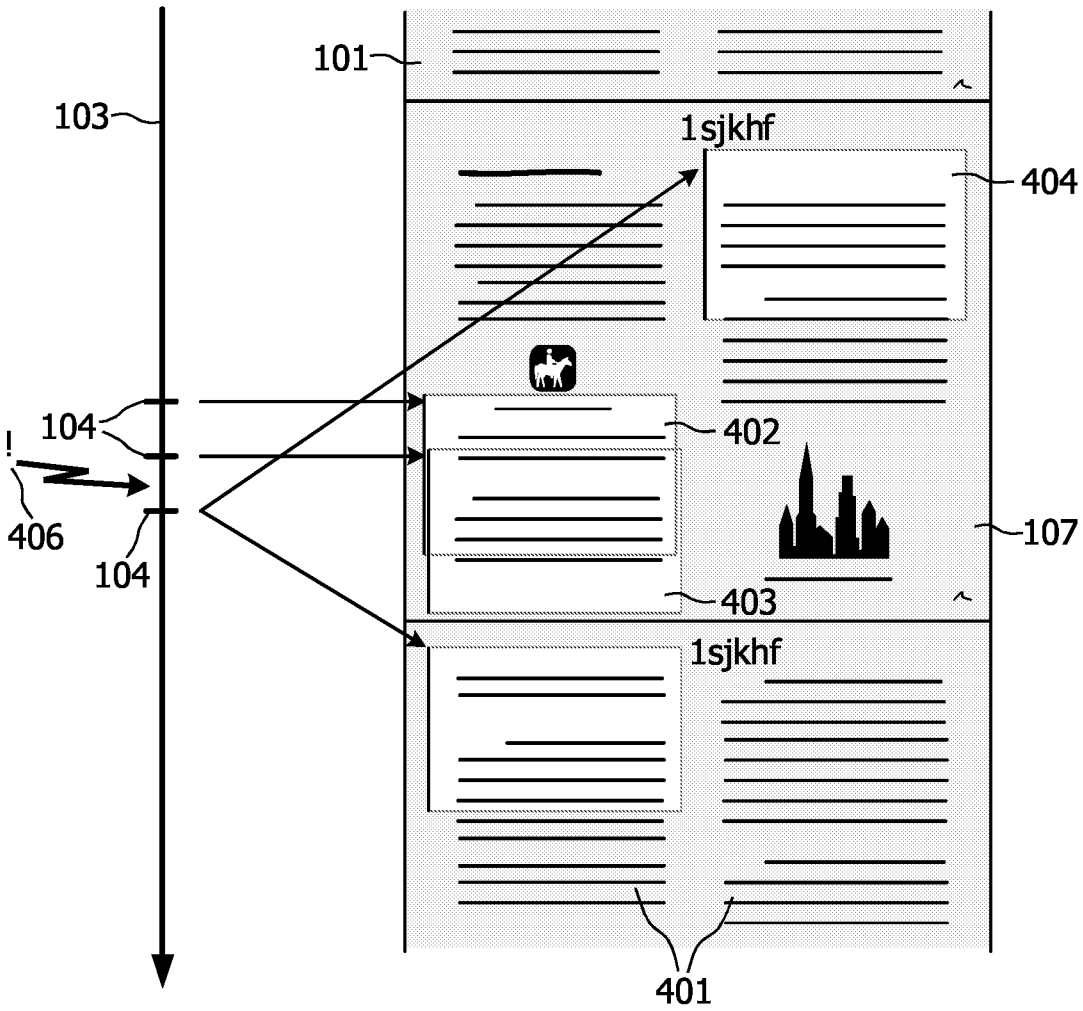

FIG. 4

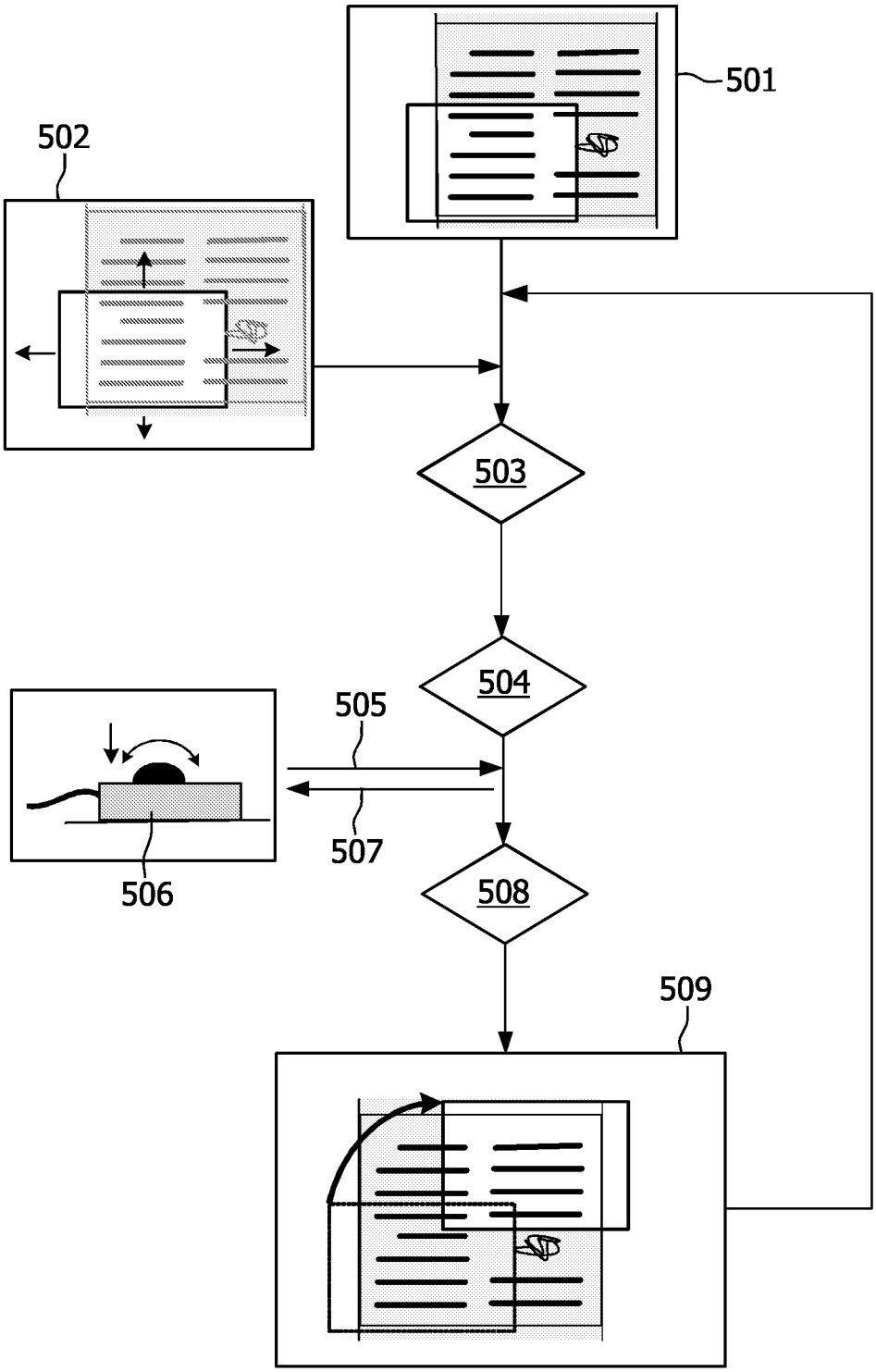

FIG. 5

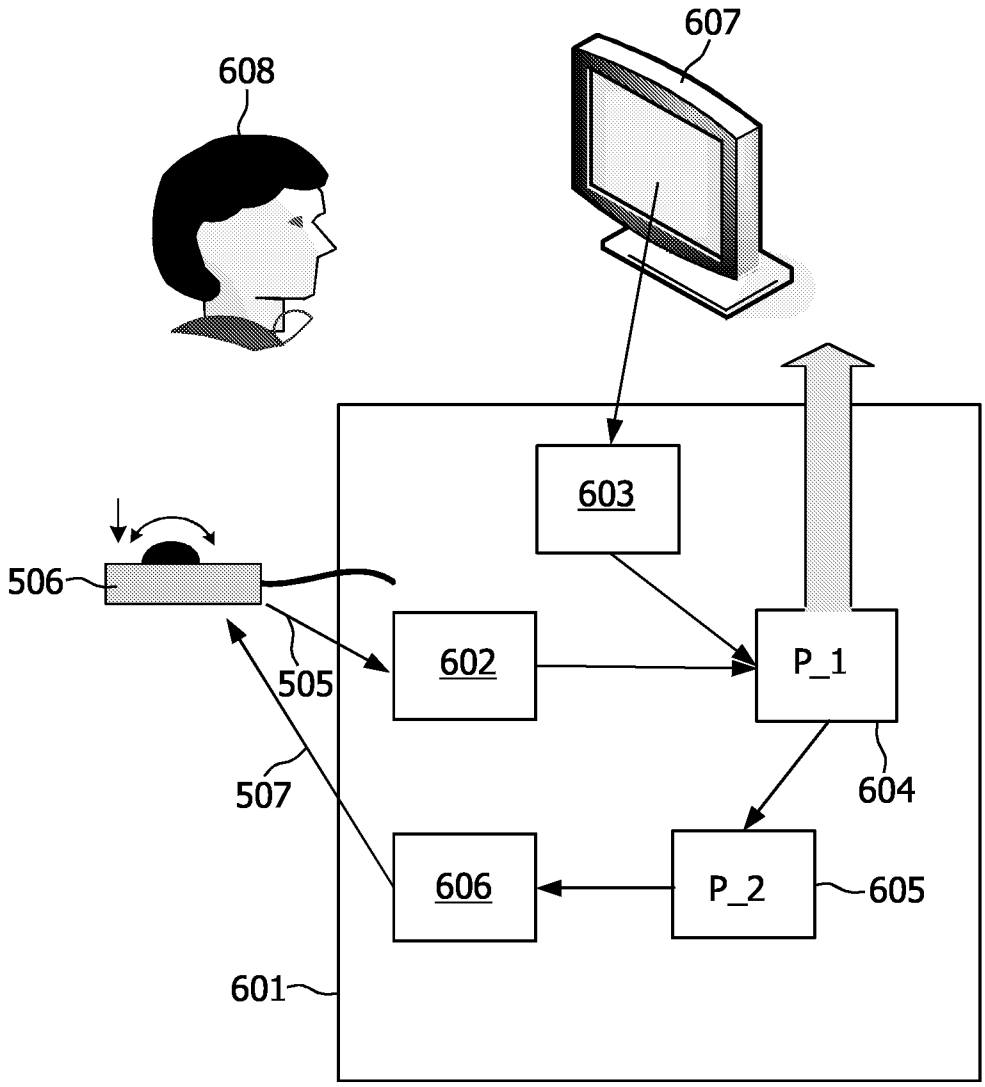

FIG. 6