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Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

(54) Title: EXTRAPOLATING X-Y COORDINATE READER

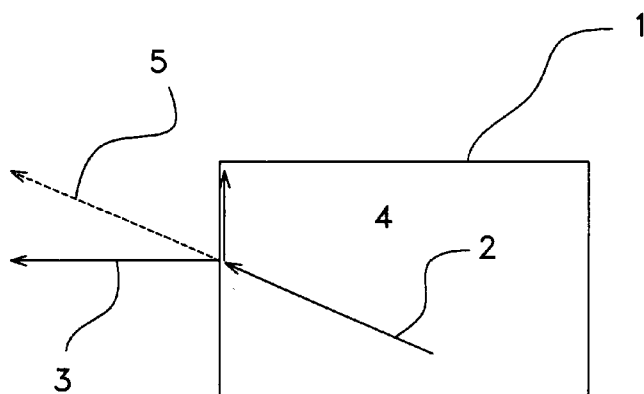


Fig. 1

(57) Abstract: The invention refers to an x-y coordinate reader comprising a reading part which read coordinates along at least a first and a second direction. The x-y coordinate reader has a range within which at least the first coordinate is allowed to move, and an end position sensor which detects if a range limit has been reached. The x-y coordinate reader comprises a calculating unit which calculates an estimate for a motion vector when an end position is reached and uses at least one component of this estimate to extrapolate a calculated coordinate after the end position has been reached.



Extrapolating x-y coordinate reader

The present invention refers to an extrapolating x-y coordinate reader according to the preamble of the independent demand.

The background to the invention

X-y coordinate readers of type touchpad or mice with roller bar function have a limited range within which they can read coordinates and at an end position stop the coordinate reading on the last read coordinate. This limits the x-y coordinate reader's usability and total resolution.

One purpose of the invention is therefore to provide an extrapolating x-y coordinate reader which enables generation of coordinate data outside the normally allowed area.

These and other purposes are achieved through an extrapolating x-y coordinate reader according to the characteristic parts of the independent claim.

Summary of the invention

The invention refers to an x-y coordinate reader comprising a reading part which read coordinates along at least a first and a second direction. The x-y coordinate reader has a range within which at least the first coordinate is allowed to move, and at least one end position sensor which detects if a range limit has been reached. The x-y coordinate reader comprises a calculating unit that calculates an estimate for a motion vector when an end position is reached and uses at least one component of this estimate to extrapolate a calculated coordinate after the end position has been reached.

In one design the x-y coordinate reader has a range within which the first coordinate is allowed to move and the x-y coordinate reader comprises a calculating unit which calculates an estimate for a motion along the first coordinate when an end position is reached. It uses this estimate and actual measured values for the other coordinate to extrapolate a calculated coordinate after the end position has been reached.

In an additional design the x-y coordinate reader comprises a calculating unit which calculates an estimate for a motion vector when an end position is reached and uses this estimate to extrapolate a calculated coordinate after the end position has been reached.

A brief description of the figures

Fig. 1 shows a first design of the x-y coordinate reader

Fig. 2 shows a second design of the x-y coordinate reader

Fig. 3 illustrates motion estimation with the x-y coordinate reader

Description of preferred designs

There are a variety of types of x-y coordinate readers, thus devices which read a motion of a user, typically a finger- or hand movement and transform this to coordinate information which is sent to a receiver, typically a computer. Examples of such x-y coordinates are computer mice, **touchpads** and similar. Many types accept motion only over a limited area and if the user tries to force the x-y coordinate reader to indicate coordinate information outside the allowed area the x-y coordinate reader tends to interpret the motion as if it has stopped at the limit of the allowed area.

Fig. 1 shows a first design of the x-y coordinate reader which can be used with so-called scroll mice 1a, thus x-y coordinate readers with a roll or belt which can rotate an unlimited number of turns around an axis and be moved in a direction parallel to the rotation axis. The movement can only take place within a limited range and the device is mechanically prevented from being moved further than to two end positions, one right end position and one left end position. The mouse with roller bar function is equipped with end position sensors which detect if either end position has been reached.

In the figure the user has moved the roller bar function linearly as illustrated by the arrow 2 which extends over the active motion area of mouse with roller bar function, until the left edge of the motion area has been reached. At the edge the user can no longer force the mouse with roller bar function further to the left but can continue the motion component which extends upwards in

the figure as illustrated by the upward arrow 4. When the end position has been reached the mouse with roller bar function extrapolates the user's presumed continued motion component in the paper plane's right-left direction 3 and the extrapolation is done by this motion component remains the same as it was up until the left edge of the motion area was reached.

The motion component in the paper's upwards downwards direction 4 can on the other hand continue to be measured since the user can continue to move the mouse with roller bar function in this direction. The total extrapolated continued motion is here assumed to be the sum of both these motion components and is illustrated by a dotted arrow 5 in the extension of the arrow 2 which illustrates the motion direction just as the mouse with roller bar function reaches the left edge of the allowed motion area.

Fig. 2 shows a second design of the x-y coordinate reader which can be used with touchpads 1b, but also this design can be used with scroll mice. In the same way as in the first design the user has just before the left edge has been reached touched the x-y coordinate reader in the way illustrated by an arrow 2 which extends over the allowed motion area. The x-y coordinate reader then continues to send coordinate data based on an extrapolation from when the left edge was reached and with a continued linear motion in the same direction and at the same speed as before the edge was reached. If the user ceases being at the edge, this motion ceases.

Fig. 3 illustrates motion estimation with the x-y coordinate reader when an actual, nonlinear motion is used which is illustrated by a graph of the allowed motion area. The x-y coordinate reader can with regular intervals make an estimation of the motion's direction and speed, which is illustrated by the series of arrows which follow the graph. Since actual coordinate data are quantized an estimate of motion direction and speed which only are based on the two last coordinate data pairs can be imprecise. More advanced motion estimates can be obtained by using more than the two last coordinate pairs before the edge is reached and one can consider advanced nonlinear estimates, but the principle is still that the estimated linear motion vector or one of its parameters, x or y, is assumed to remain unchanged after the end position has been reached.

The x-y coordinate reader can consist of an interconnected separate unit which comprises the calculating units required for estimating the motion's extrapolated motion after a limit position has been reached. Alternatively the x-y coordinate reader can of course in itself only send data if actual current values in terms of measured coordinates and whether a possible end position has been reached. The motion estimation and the extrapolation can then be done in the receiving unit, thus typically the computer on whose screen a cursor's position is controlled by the output data of the x-y coordinate reader.

The end position sensor is here described as a separate, physical part, but obviously can with for instance a touchpad simply the coordinate information itself be used, thus that the user points to a location just at the outer edge of the touchpad's active area. Alternatively can for a touchpad the end position be considered to be reached when the user has moved his finger over the active area and thereafter position data cease to exist, thus the finger is outside the active area and consequently the end position status is activated, despite the fact that no separate end position sensor as such exists. All these and of course other corresponding functions are here meant end position sensor.

When the end position has been reached and an extrapolation is to occur the extrapolation can assume that the continued motion occurs at the same speed and direction as when passing over the end position. Alternatively can of course the extrapolation assume that the motion continues in the same direction, but at another speed, for example 70% or 50% of the speed prevailing before reaching the end position. The extrapolation can also be done nonlinear; for example can a curved motion that existed just before the end position was reached be expected to continue. All these and other possible forms of extrapolation are of course referred to here.

Claims

1. An x-y coordinate reader comprising a reading part which reads coordinates along a first and a second direction, where the x-y coordinate reader has a range within which the first coordinate is allowed to move while the x-y coordinate reader allows the other coordinate to move mainly without restriction, and at least one end position sensor which detects if a range limit has been reached, **characterized by** that the x-y coordinate reader comprises a calculating unit which calculates an estimate for a motion along the first coordinate when an end position is reached and uses this estimate and actual measurement values for the other coordinate to extrapolate a calculated coordinate after the end position has been reached.

1/2

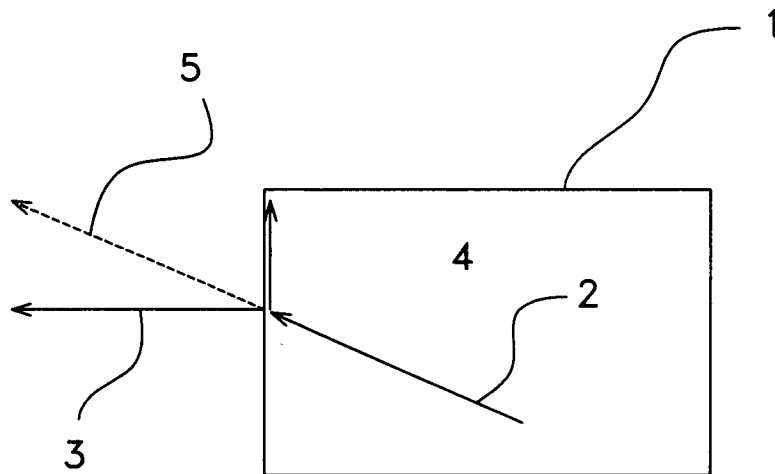


Fig. 1

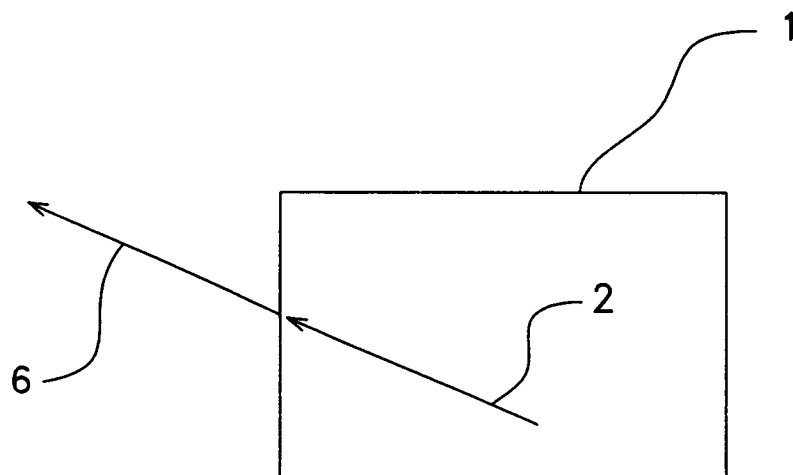


Fig. 2

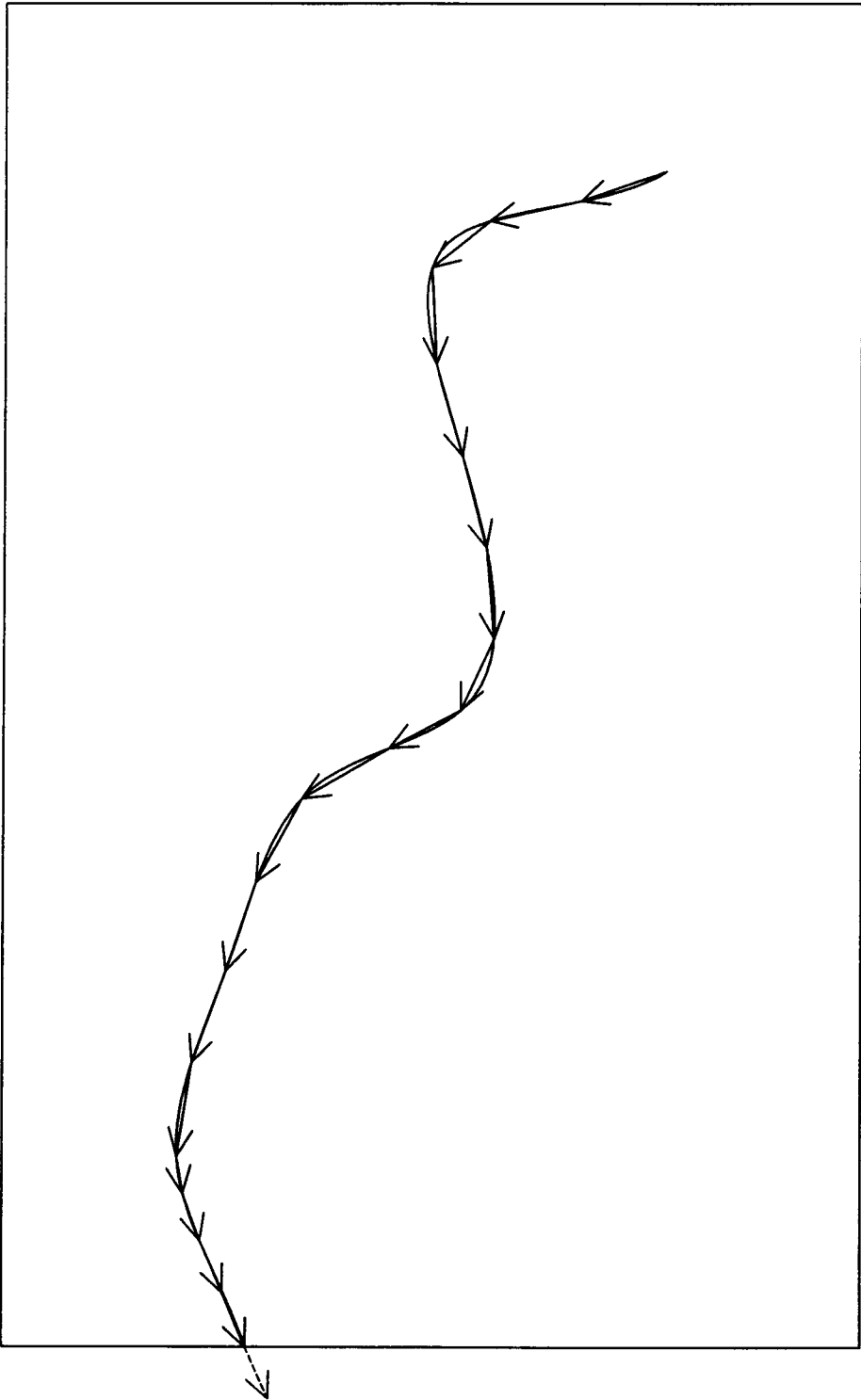


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2014/000063

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20030043113 A1 (ITOH AKIHISA), 6 March 2003 (2003-03-06); paragraphs [0092]-[0095]; figure 6 --	1
A	US 20110109575 A1 (LII JIA-YIH ET AL), 12 May 2011 (2011-05-12); figure 8 --	1
A	US 5880717 A (CHAN CHOW FONG ET AL), 9 March 1999 (1999-03-09); figures 3,6a-6d -- -----	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

01-09-2014

Date of mailing of the international search report

02-09-2014

Name and mailing address of the ISA/SE

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2014/000063

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 1 (in part)
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Claim 1 is not supported by the description as required by Article 6 PCT, as its .../...

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Continuation of: Box No. II

scope is broader than justified by the description and drawings. The reasons therefor are the following: The expression "the x-y coordinate reader allows the other coordinate to move mainly without restriction" used in claim 1 is not supported by the description.

The search has been limited to the particular embodiment termed in the description (page 2, lines 16-22): "x-y coordinate readers with a roll or belt which can rotate an unlimited number of turns around an axis".

Continuation of: second sheet**International Patent Classification (IPC)****G06F 3/033** (2013.01)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2014/000063

US	20030043113 A1	06/03/2003	JP	3909230 B2	25/04/2007
			JP	2003076489 A	14/03/2003
			TW	571224 B	11/01/2004
			US	7348965 B2	25/03/2008
US	20110109575 A1	12/05/2011	TW	201117069 A	16/05/2011
			TW	1411946 B	11/10/2013
US	5880717 A	09/03/1999	NONE		