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(54) **Digitisation method of the information contained in analogue tachographs**

(57) Digitisation method of the information contained in analogue tachographs, which is robust against noise in the main chart, which, from the scanned image of the analogue card, allows the automated determination of the position and the orientation of the card in the image, converting the information recorded in a circular manner

to linear for the automated extraction of the parameters start and final end of the period of activity of the driver, as well as events occurring during said period, i.e. driving, other duty, standby and rest periods; kilometers of distance travelled and periods of driver and co-driver states, when the driver is working in a team mode.

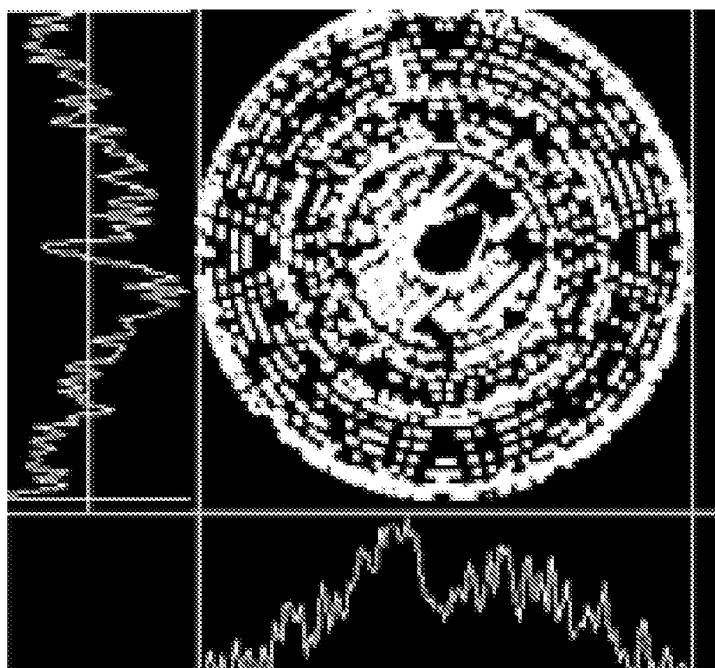


Figure 9

Description

Object of the invention

[0001] Digitisation method of the information contained in analogue tachographs.

[0002] The invention relates to a method for extraction of the information contained in the charts on which the card information is stored in today's analogue tachographs, said method can be extended to other types of system based on the graphic recording of symbols on paper in the same way as, for example, electrocardiograms, polygraphs, etc.

[0003] For the above, from a scanned image of a card from an analogue tachograph, in any position and orientation, the following information is obtained: start and final end of the period of activity of the driver, events occurring during this period, i.e, driving, other duty, standby and rest periods; kilometers of distance travelled; period of single driver and co-driver, when the driver has been working as part of a team.

Background of the invention

[0004] Today, methods of reading and interpretation of tachograph cards are based, with the aid of template registers, on the visual interpretation thereof. Thus, for example, a typical manual tachograph card reader is based on a system with an illuminated magnifying lens and a small keyboard for the operator and several coloured diodes which act as visual aids for the operator of the device.

[0005] In this way, the reading systems for tachograph cards largely depend on visual precision, leading to interpretation errors.

[0006] Methods for extraction of information from analogue tachograph cards are known from the scientific literature. (1) Antonacopoulos, A. y Kennedy, A.P., 2001. "Information Extraction from Complex Circular Charts." Proceedings of the Conference on Document Analysis and Recognition, Seattle, WA, USA, 784-787. (2) Antonacopoulos, A., y Kennedy, A.P., 2002. "An Automated Tachograph Chart Analysis System." Proceedings of the International Workshop on Document Analysis Systems, LNCS 2423, Princeton, NJ, USA, 544-555.

[0007] The object of the present invention is to provide an electronic reading method for tachograph cards providing remarkable improvements in reading speed, precision and efficiency of the reading of data, as well as to convert said reading in texts or numbers without the need for human visual interpretation of data.

Description of the invention

[0008] Digitisation method of the information contained in analogue tachographs, which is robust against noise in the main chart, allowing to determine automatically the position and orientation of the card from the

scanned image of an analogue card, converting the information recorded in a circular manner to linear for the automated extraction of the parameters of start and final end of the period of activity of the driver, as well as events occurring during said period, according to the flow diagram shown in Figure 2.

[0009] The method consists of three steps: 1) detection of the card, 2) calculation of its orientation, and 3) data extraction. In the third step, the method allows extraction of the following information: 3.1) extraction of events, 3.2) detection of driver and co-driver, i.e. when the driver works as part of a team, periods, and 3.3) calculation of the distance travelled.

[0010] The methodology of the two first steps is shown in the flow diagrams in figures 3 and 4. respectively. For the extraction of the shape of charts, where data are stored, the method shown in Figure 5 is applied, designated "forward-backward floodfill" (FBF). Finally, Figures 6, 7 and 8 show the methodology for solving the cases 3.1, 3.2 and 3.3. All said methods are described below.

Step 1: Detection of the card

[0011] The card is detected in the image by means of contrast analysis. This process is executed on the image rescaled to a smaller size for speeding up the process. The variance in the image is calculated for each area and the card is detected by means of horizontal and vertical projections (Figure 9). The diameter of the card is determined as the largest dimension from width and height of the detected card.

Step 2: Calculation of the orientation

[0012] The calculation of the orientation of the card consists of the detection of the direction at 12 hours and at 24 hours. The centre shape of a card is shown in figure 10. The method consists of adjusting the image to a 2D model which has been predefined as a list of dots.

Step 3: Data extraction

[0013] Once the centre and orientation of the centre of the card has been located, the cartesian coordinates of the image are converted to polar coordinates to obtain an unfolded image of the card. From this image, the information contained in the card is extracted.

Step 3-Case 1 Extraction of activity events

[0014] The events on the activity trace are extracted by measuring the thickness of the signal line. The start and end of the activity are calculated from the list of events obtained searching for the largest gap between events of the same day or of consecutive days.

Step 3-Case 2 Extraction of driver and co-driver periods

[0015] An event will be classified as "co-driver" when it relates to driving and shows a zero speed line. This process consists of detecting the zero speed line and searching for gaps on it.

Step 3-Case 3 Calculation of the distance travelled

[0016] For the extraction of data on distance travelled during driving events, the process will consist on detecting the skeleton of the distance trace, and then detecting the rise and fall peaks. Each rise or fall represent 5 km of distance travelled. The output is a list giving distance travelled each minute and the list of peaks.

[0017] Figure 13 shows an example of the digitisation output of an analogue card obtained using the described methods, showing a correct unfolding of the image and how initial and final positions of the period of activity and of the different events are obtained from it.

Brief description of drawings

[0018] To complete the description above and for a better understanding of the features of the present method, the set of attached figures is given as integral part of said description, in which, as non-limiting illustration of the invention, the following is represented;

Figure 1. It illustrates an analogue tachograph card.
Figure 2.- Flow diagram of the general digitisation process of the information contained in analogue tachographs.

Figure 3.- Flow diagram of the method of detection of position of the card in the scanned image.

Figure 4.- Flow diagram of the method of re-orientation of the card in the scanned image for its subsequent unfolding.

Figure 5.- Flow diagram of the method of extraction of scanned charts containing relevant information, designated "forward-backward floodfill" (FBF).

Figure 6.- Flow diagram of the method of extraction of activity events of the driver.

Figure 7.- Flow diagram of the method of extraction of driver and co-driver periods.

Figure 8.- Flow diagram of the method of extraction of distance travelled.

Figure 9.- It illustrates the detection of the card using the variance image and its horizontal and vertical projections.

Figure 10.- It illustrates the shape of the centre of the card.

Figure 11.- It illustrates the detected edges and the image of the distance transform.

Figure 12.- It illustrates the clock tick marks and their vertical projection.

Figure 13.- It illustrates the unfolding as a band of the information contained in the analogue card after

digitisation.

Claims

1. Digitisation method of the information contained in analogue tachographs, **characterized in that**, from a scanned image of an analogue card, it allows the automated determination of the position and orientation of the card on the image.
2. Digitisation method of the information contained in analogue tachographs, according to claim 1, **characterized in that** it is robust against noise in the image, allowing the filtering of possible marks or symbols not belonging to the main graphic signal.
3. Digitisation method of the information contained in the analogue tachographs, according to claims 1 and 2, **characterized in that** it allows unfolding in the form of a band of the information in the analogue card.
4. Digitisation method of the information contained in analogue tachographs, according to claims 1 and 2, **characterized in that** it allows to match in a direct way the information in analogue tachographs with that in digital tachographs.
5. Digitisation method of the information contained in analogue tachographs, according to claims 1 and 2, allowing to obtain the start and final end of the period of activity of the driver.
6. Digitisation method of the information contained in analogue tachographs, according to claims 1, 2 and 5, allowing to obtain data relating to driving, other duty, standby and rest periods.
7. Digitisation method of the information contained in analogue tachographs, according to claims 1, 2 and 5, allowing to obtain the information on kilometers of distance travelled.
8. Digitisation method of the information contained in analogue tachographs, according to claims 1 and 2, **characterized in that** it allow to obtain the periods of driver and co-driver states, when the driver is working in a team mode.
9. Digitisation method of the information contained in analogue tachographs, according to claims 1 and 2, **characterized in that** it is also applicable to all types of graphic signals recorded on paper, preferably electrocardiograms and polygraphs.

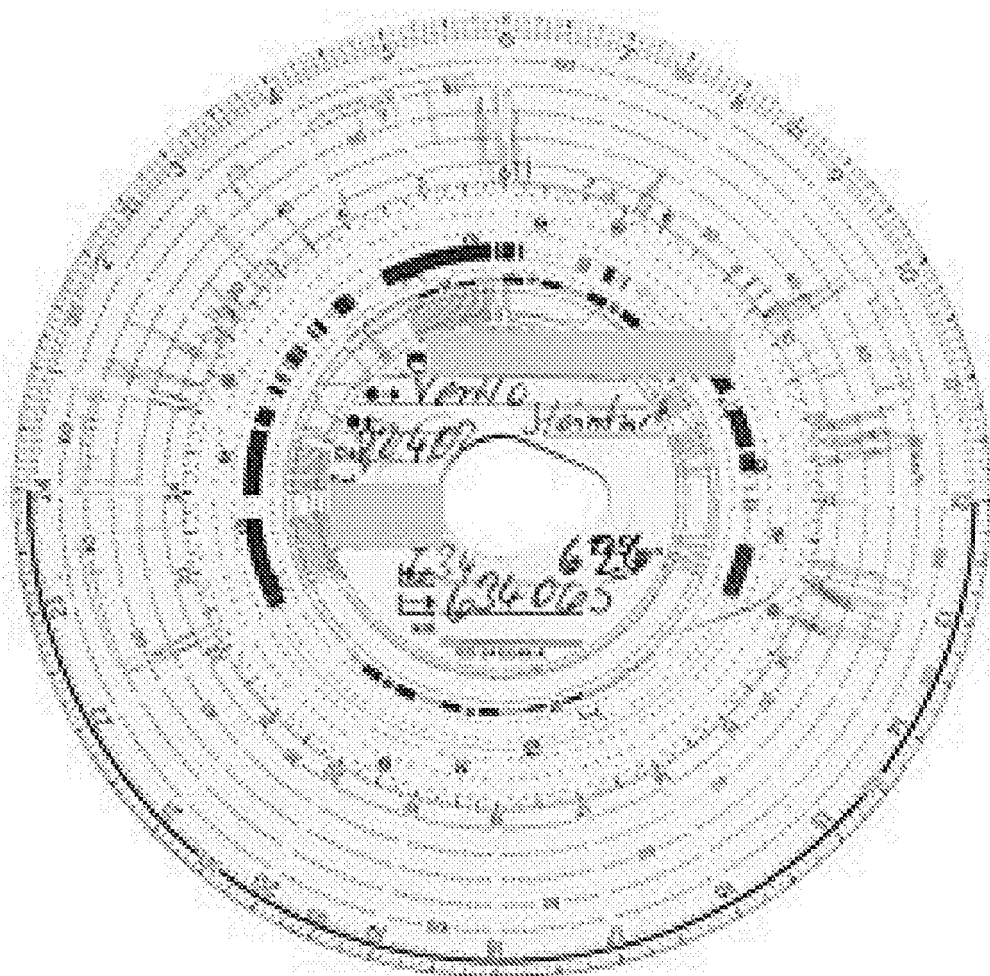


Figure 1

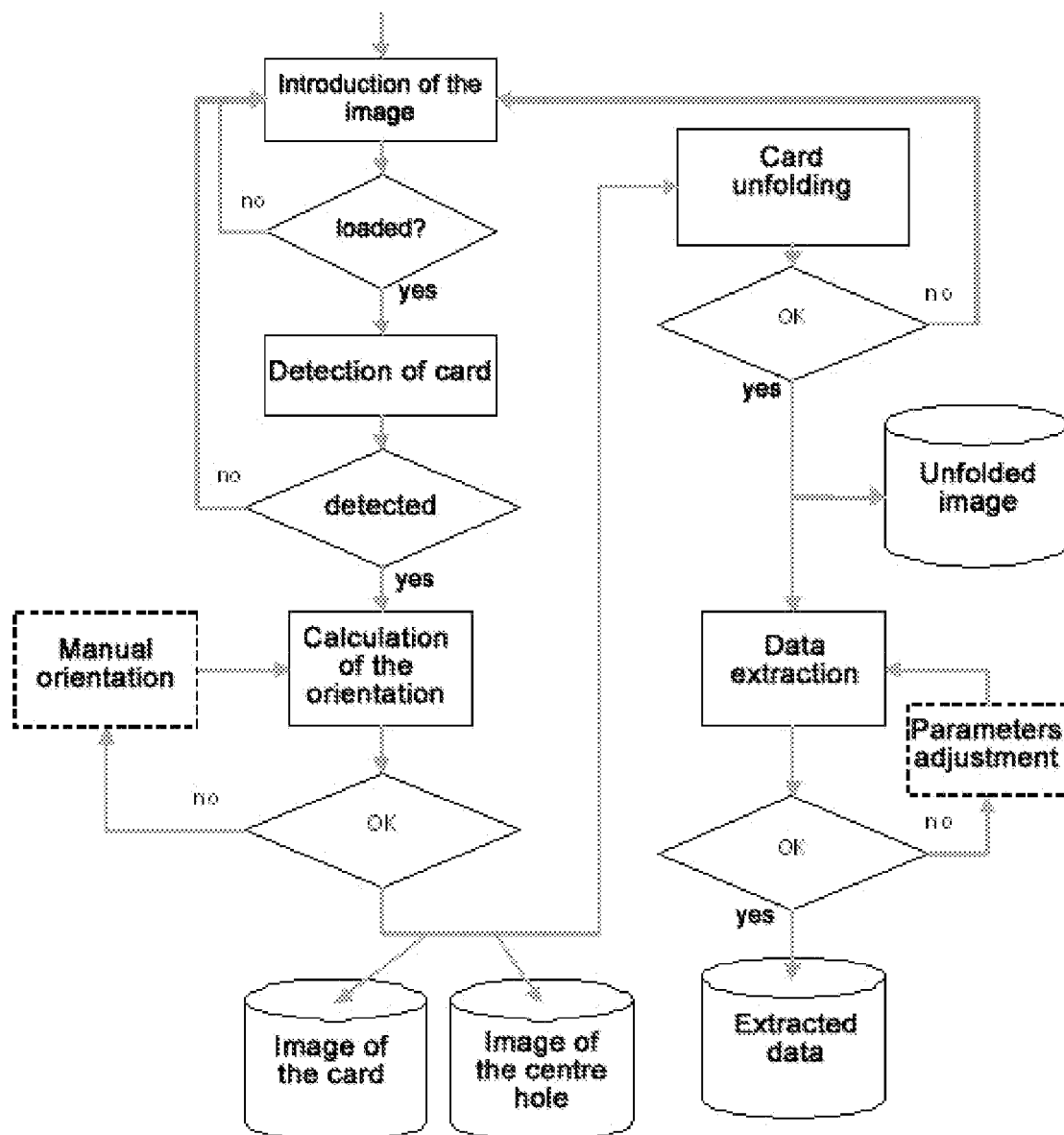


Figure 2

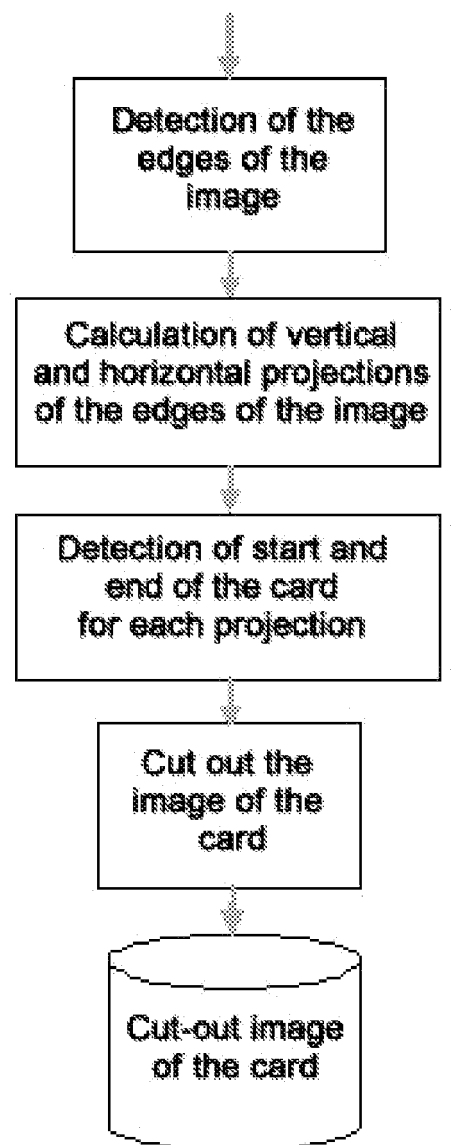


Figure 3

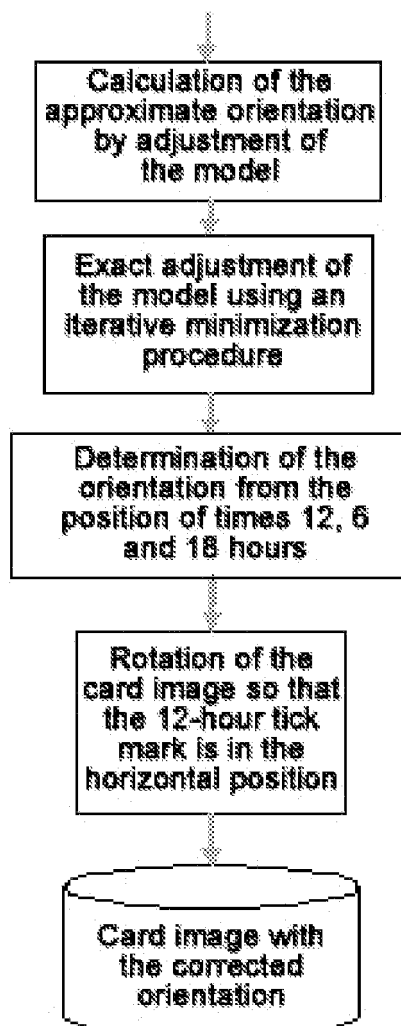


Figure 4

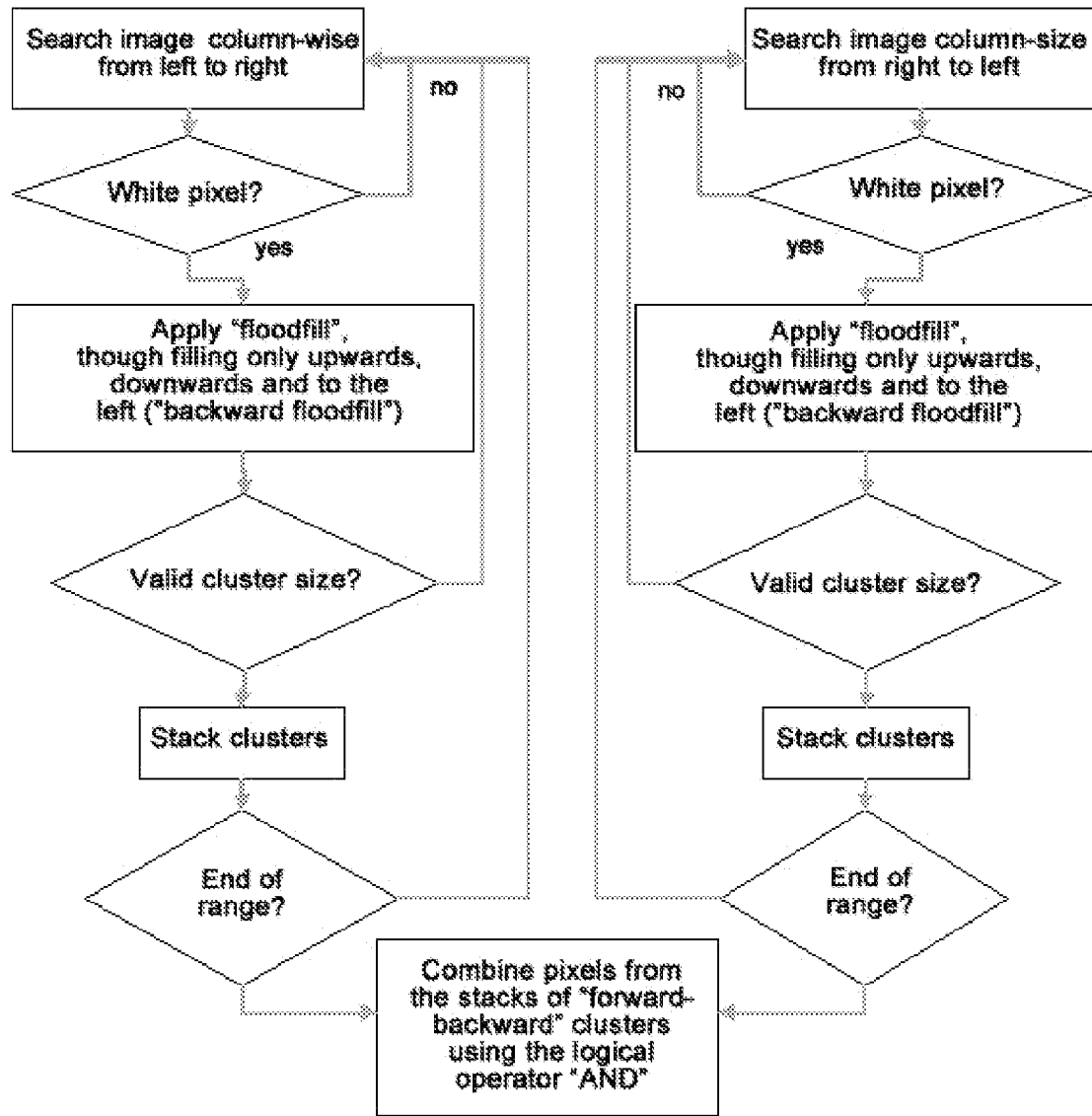


Figure 5

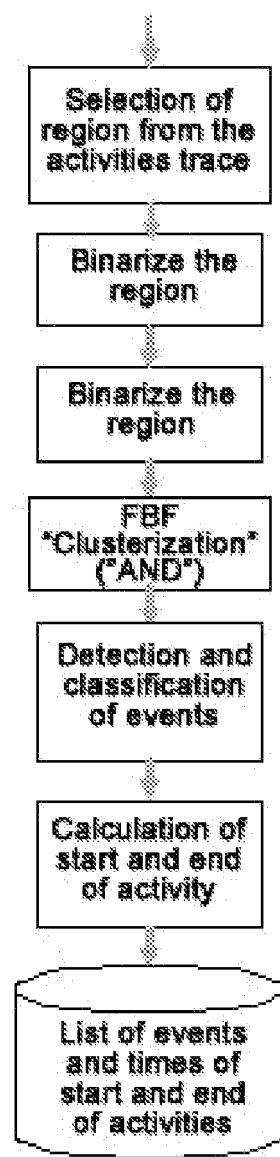


Figure 6

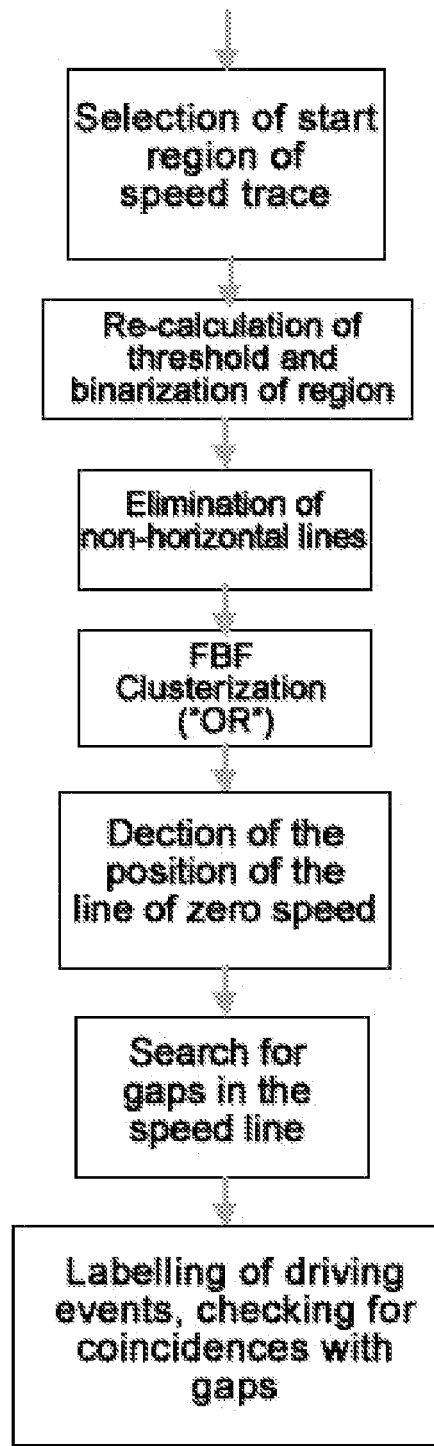


Figure 7

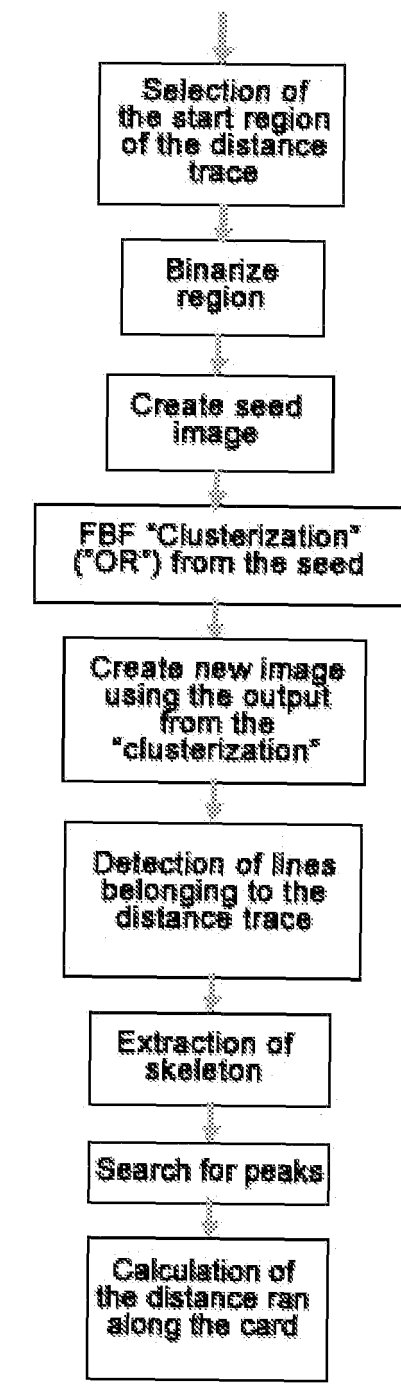


Figure 8

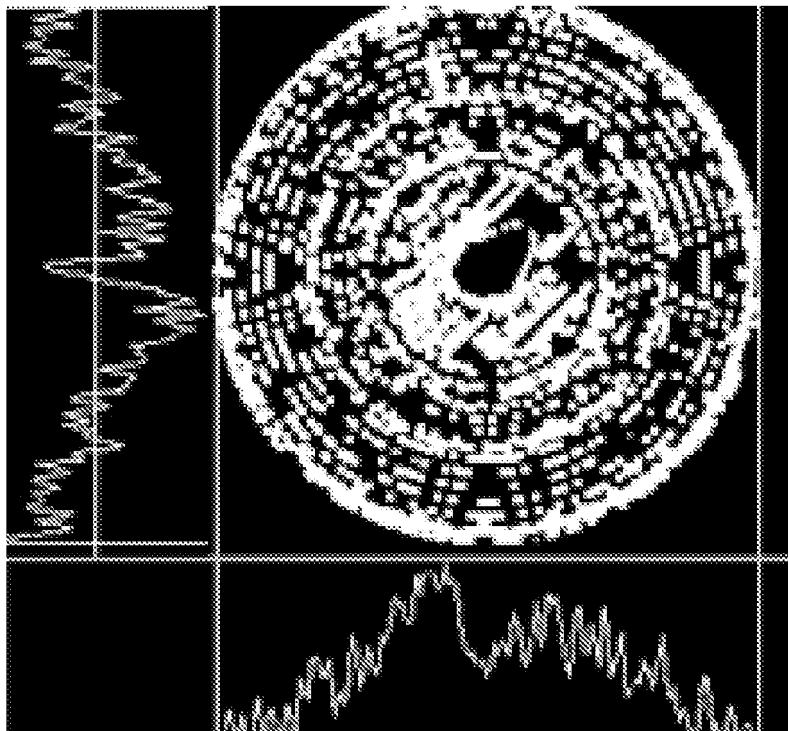


Figure 9

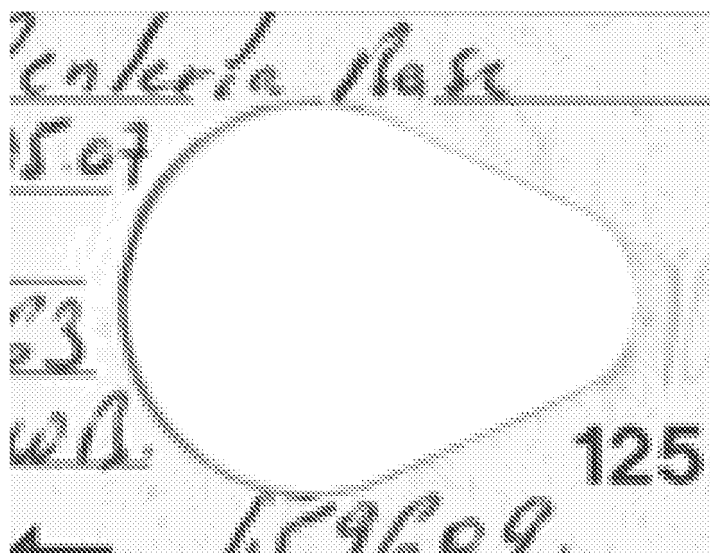


Figure 10

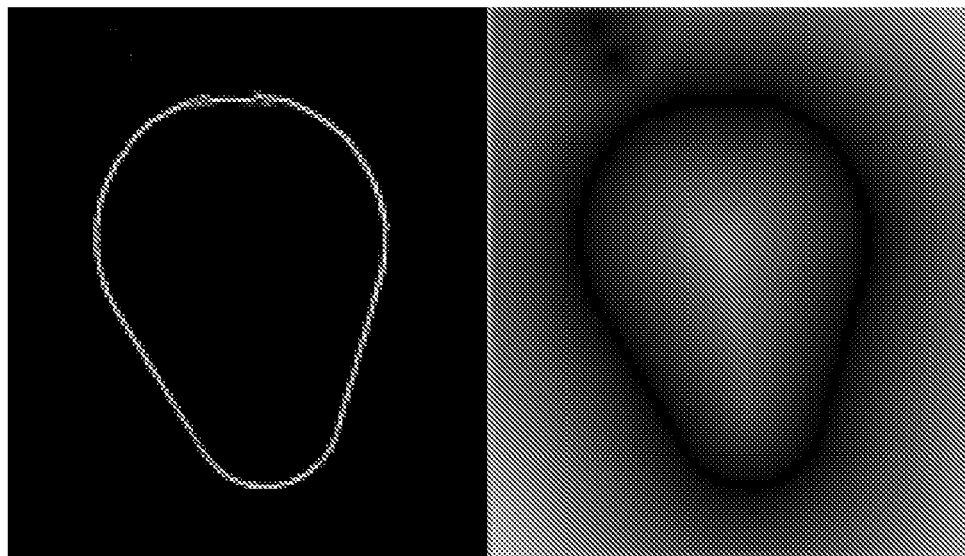


Figure 11

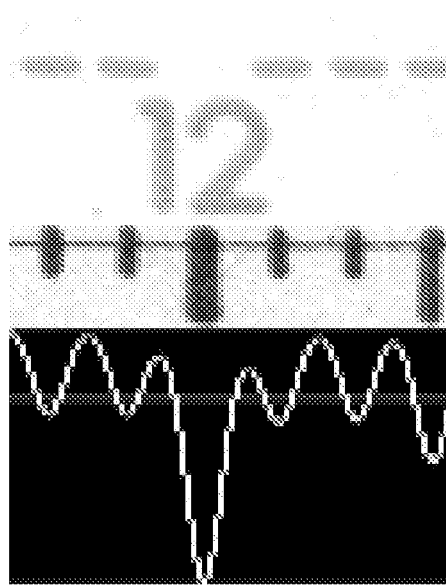


Figure 12

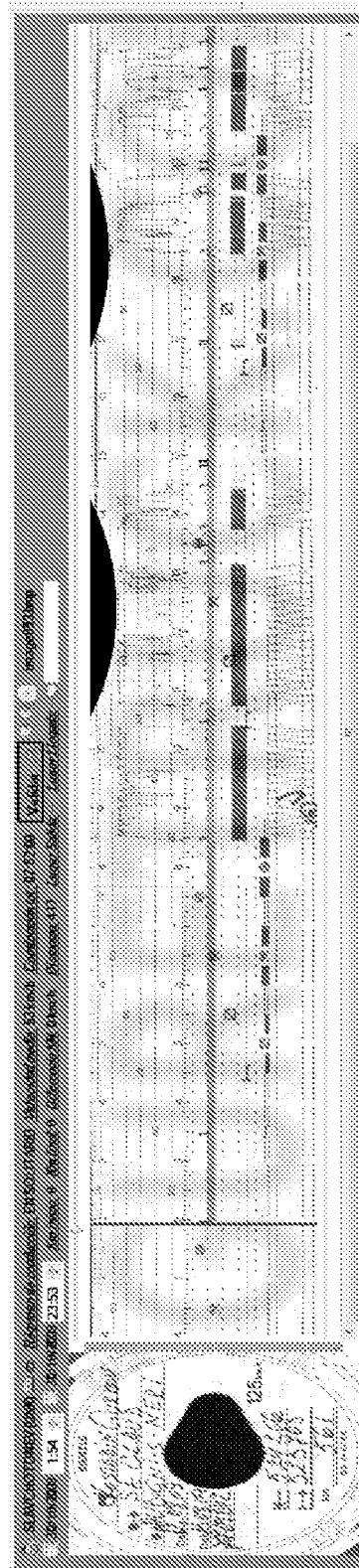


Figure 13



EUROPEAN SEARCH REPORT

Application Number
EP 10 00 4665

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 93/08543 A1 (TRUTAC LIMITED [GB]) 29 April 1993 (1993-04-29)	1-8	INV. G07C5/00
Y	* page 2, last paragraph - last paragraph *	9	
	* page 7, paragraph 2 - paragraph 6 *		
	* page 10, last paragraph - page 12, last paragraph *		
	* figure 1/1 *		

X	EP 1 146 486 A2 (DAITO MECHATRONICS CO LTD [JP]; SP KIKAKU CO LTD [JP]) 17 October 2001 (2001-10-17)	1-8	
	* paragraph [0050] - paragraph [0051] *		
	* paragraph [0007] - paragraph [0016] *		
	* paragraph [0022] - paragraph [0035] *		
	* figures *		

X	DE 199 41 631 A1 (BUNJES GERD [DE]) 21 June 2000 (2000-06-21)	1,4-7	
	* the whole document *		

Y	US 2006/264769 A1 (SATIN SCOTT L [US] ET AL) 23 November 2006 (2006-11-23)	9	TECHNICAL FIELDS SEARCHED (IPC)
	* paragraphs [0029], [0040] *		G07C

The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 September 2010	Examiner Miltgen, Eric
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 00 4665

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29-09-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9308543	A1	29-04-1993	AT 180078 T 15-05-1999
		AU 2690392 A 21-05-1993	
		DE 69229178 D1 17-06-1999	
		DE 69229178 T2 16-12-1999	
		EP 0608297 A1 03-08-1994	
		ES 2131076 T3 16-07-1999	
		GB 2275336 A 24-08-1994	

EP 1146486	A2	17-10-2001	JP 2001297391 A 26-10-2001

DE 19941631	A1	21-06-2000	NONE

US 2006264769	A1	23-11-2006	NONE

REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- **ANTONACOPOULOS, A. ; KENNEDY, A.P.** Information Extraction from Complex Circular Charts. *Proceedings of the Conference on Document Analysis and Recognition*, 2001, 784-787 **[0006]**
- **ANTONACOPOULOS, A. ; KENNEDY, A.P.** An Automated Tachograph Chart Analysis System. *Proceedings of the International Workshop on Document Analysis Systems, LNCS*, 2002, vol. 2423, 544-555 **[0006]**