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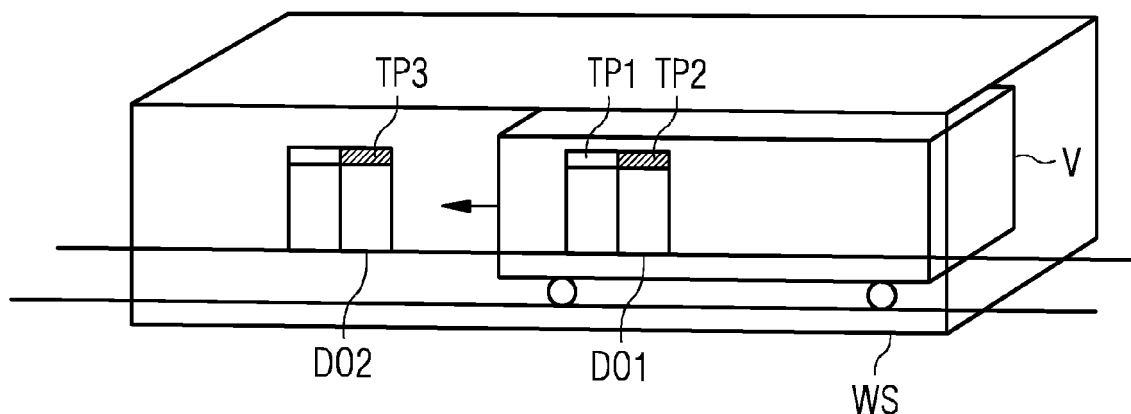
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(54) **Method and system for managing an automatic opening of first doors of a vehicle and second doors of a platform**

(57) The present invention proposes a system for managing an opening for a first and a second sets of automatically doors, the first set (D01, D02) belonging to a vehicle (V) and the second set belonging to a platform at the wayside (WS) of the vehicle, both sets of doors having to be positioned exactly in front of each others before a command of opening them is validated, characterized in that :
- at least two doors, one of the first set and another of

the second set to be positioned in front of each other, provide a transparency pattern on a part of their window, said at least one pattern (TP3) allowing to transmit an amount of light within and through its associated window, - a unit for measurement of said amount of transmitted light over said pattern is emitting at least one trigger signal as the vehicle approaches the platform, said trigger signal commanding a stop at a defined relative position between the vehicle and the platform and enabling an opening of the sets of doors.

FIG 1



Description

[0001] The present invention concerns a system for managing an automatic opening of first doors of a vehicle and second doors of a platform at which side said vehicle is approaching, in particular in public transport, according to claim 1.

[0002] The present invention relates generally to a secure automatically opening of swing doors that permits a flow of passengers and/or merchandise entering and leaving a vehicle from or onto a platform, said vehicle being for example a public transportation, a distribution chain or a lift.

[0003] In the present invention the example of a public transportation like a metro, a trolley, a train will be privileged because it covers all aspects for which the invention applies.

[0004] Especially some recent automatic door opening systems includes two sets of automatic swing doors, a first set on board of the vehicle and a second set on a platform at the wayside of said vehicle like in a train station. If the vehicle is approaching and stops at the platform, an exact positioning of both sets of swing doors is major in order to ensure to avoid a risk for passenger to be blocked or even injured. As well a not exact positioning of both sets of doors in front of each other will reduce the flow of passenger entering and leaving the vehicle, giving rise for example to a general public transport delay and to network congestions.

[0005] Usually it is foreseen that the driver of the train, an operator on the platform or an ATC based command (in case of CBTC-Command Based Train Control for automatic train, including the case of a train without driver) triggers the automatically opening of such sets of doors, but all this systems or methods suffer from an uncertainty of spatial positioning of both sets of doors, especially if the length or an endstop position of the train is variable or does not match the length or a stop reference point of the platform.

[0006] It is therefore an objective of the present invention to provide a system for managing effectively an automatic opening of first doors of a vehicle and second doors of a platform at which side said vehicle is approaching for stopping in order to avoid the above-mentioned problems.

[0007] This objective is achieved according to the present invention with respect to a system for managing an opening for a first and a second sets of automatically doors, the first set belonging to a vehicle and the second set belonging to a platform at the wayside of the vehicle (by approaching a platform at wayside), both sets of doors having to be positioned exactly in front of each others before a command of opening them is validated, characterized in that :

- at least two doors, one door of the first set and the another of the second set, said doors having to be positioned in front of each other provide a transpar-

ency pattern on a part of its window, said at least one pattern allowing to transmit an amount of light within and through its associated window,

- a unit for measurement of said amount of transmitted light over said pattern is emitting at least one trigger signal as the vehicle approaches the platform, said trigger signal commanding a stop at a defined relative position between the vehicle and the platform and enabling an opening of the sets of doors.

[0008] A preferred system is very simple to realize in that the pattern comprises a transparency area with opaque borders whose length is maximally equal to a width of a glass window of a door and whose width is at least equal to a portion of height of said glass window. Such a pattern can be e.g. realized by means of a rectangular sticker along the whole top of each of the windows, said sticker including a hollow transparency area.

[0009] A similar preferred system is as well possible in that the pattern comprises a transparency area with opaque borders whose height is maximally equal to a height of a glass window of a door and whose width is at least equal to a portion of width of said glass window. Such a pattern can be e.g. realized by means of a rectangular sticker along the (whole) lateral side of each of the windows, said sticker including a hollow transparency area.

[0010] In order to compensate the uncertainty of the relative positioning between both sets of doors, the system according to the invention can comprise that at least one of the pattern comprises a light coded transparency area. By this way the amount of transmitted light over two patterns that move in front of each other can be coded so that one or more peaks of light are measured during the slow approach of vehicle at the platform and provides an information on the time/location to stop the vehicle exactly at a required position for both set of doors.

[0011] Ideally the unit of measurement of system according to the invention comprises a line or an array light sensor, like a video camera, ideally located at the wayside or between the two sets of doors. Major is that the unit of measurement is located at a place where noisy lighting and even shadowing are minimized/eliminated so that only the light being transmitted over both pattern can be measured.

[0012] In the same issue, such an improvement for guarantying a high signal-to-noise ratio of the transmitted light signal, the system according to the invention can include a lighting mean which is located closed to patterns for illuminating sufficiently all transparency area of said pattern and ensuring a sufficient amount of light to be measured by the unit of measurement. Such an illuminating can be a simple array of diodes which provides enough lighting to image the alignment relative to the second pattern to be superposed on the first one. It is also possible to provide a first pattern with lighting means at the location of its usual transparency areas and the second pattern to be aligned in front of the first pattern

provides only transparency parts which are free of lighting means.

[0013] Finally the accuracy of the system according to the invention can be also improved in that it comprises a mean of pattern recognition with an input to an output signal of the unit of measurement and with an output delivering the trigger signal to a control unit for commanding a stop at a defined relative position between the vehicle and the platform and enabling an opening of the sets of doors. Over such recognition means some deficiencies in term of signal-to-noise of a transmitted lighting though a pattern can be compensated. As unit of measurement in that case, a simple survey camera on board or at the wayside can be used in order to check the position of a relative moving pattern inversely at the wayside or on-board. The stop of the vehicle and the opening of the sets of doors are hence foreseen as the pattern is imaged within an accurately defined region of interest of the survey camera.

[0014] The invention will now be described in preferred but not exclusive embodiments with reference to the accompanying drawing, wherein:

Figure 1 system according to the invention with horizontal patterns;

Figure 2 system according to the invention with vertical patterns;

Figure 3 system according to the invention with coded patterns;

Figure 4 system according to the invention with lighted patterns;

Figure 5 system according to the invention with pattern recognition means.

[0015] Figure 1 shows a system according to the invention for managing an opening for a first and a second sets of automatically doors, the first set (DO1, DO2) belonging to a vehicle (V) - which approaches a platform of a rail station - and the second set belonging to the platform at the wayside (WS) of the vehicle, both sets of doors having to be positioned exactly in front of each others before a command of opening them is validated, characterized in that :

- at least two doors, one of the first set and another of the second set to be positioned in front of each other, provide a transparency pattern (TP1, TP3) on a part of their window, said at least one pattern (TP3) allowing to transmit an amount of light within and though its associated window,
- (non represented) a unit for measurement of said amount of transmitted light/brightness over said pattern (TP3) (assuming that first pattern TP1 on-board transmits a lighting coming from on-board to the way-

side or comprises bright regions) is emitting at least one trigger signal as the vehicle approaches the platform, said trigger signal commanding a stop at a defined relative position between the vehicle and the platform and enabling an opening of the sets of doors.

[0016] At this position both sets of doors (DO1, DO2) are exactly aligned in front of each others. By this example a left door of the first set (DO1) comprise a horizontal pattern at the top of their corresponding glass windows and which provides a rectangular transparency hollow region with dark borders along the width of each window. Only one door (right side) of the second set (DO2) at the wayside comprises a similar pattern so that after a first door of first set has moved before the right door of the second set, a first peak of transmitted light over the patterns is achieved and determines that the vehicle has to be stopped after a path equal to the width of one door. The pattern of the first set (e.g. on right side) can be completely opaque under the same size of other patterns. By this way as the right door on-board of vehicle travels before the right door at the wayside, the amount of light decreases so that the previous peak of light is easier to localize to order a next stop of the vehicle over a know length.

[0017] Figure 2 is a basically an alternative form of configuring two so called vertical patterns (TP1, TP3) for aligning the respective doors (DO1a, DO2a) of each set. The patterns comprise a transparency area with opaque borders whose height is maximally equal to a height of a glass window of a door and whose width is at least equal to a portion of width of said glass window. This alternative as well as the one of figure 1 presents the main advantage that these patterns at the borders of windows can be imaged under minimal perturbations (e.g. from passenger in front of windows) and the unit of measurement of the amount of light can be located between the doors or at the top of the rail station on wayside.

[0018] Figure 3 presents alternative patterns with specific coded light transmission properties. Said coding of patterns which are moving relative to each others as the vehicle approaches the platform has to be so chosen in order to predict/trigger when or where the vehicle will be stopped. Assuming that the width of a door is known, the patterns (TP1 on-board & TP3 wayside) including opaque and transparency regions (including e.g. here positive and negative triangle formed masks) permits to detect a punctual decrease of the amount of measured light (transparency or bright regions) that triggers an information signal on that the vehicle has still to travel over a length of a single door to be stopped. The present invention does not limit its scope to the presented coded patterns: many geometrical opaque/transparent masks are possible so that the measured amount of transmitted light (or the apparent transparent region) provides a trigger signal for informing on when and where the vehicle has to stop.

[0019] Figure 4 presents a system according to the invention with a first pattern (TP1, on-board) composed by a plurality of optical diodes that are arranged along the transport direction of the vehicle. By this way the array of diodes is a lighting mean that is located closed to the first pattern (on-board) for illuminating transparency areas of said second pattern (TP3, wayside) and ensuring a sufficient amount of light to be measured by the unit of measurement. The distances between at least some of the diodes can be chosen non-linear so that a specific coding of transmitted spots is enabled in order to detect a trigger signal providing the related information on when/where the vehicle has to stop.

[0020] Figure 5 presents a system according to the ones of figure 1 to 4 providing patterns (here with a new mask coded patterns comprising opaque and transparent regions) which overlap during the approach of the vehicle at the platform of wayside. A camera (CAM) as unit of measurement of the amount of light transmitted from the vehicle to the wayside though both on-board and wayside patterns (TP1, TP3) is imaging the field of the second pattern (TP3). In other words the camera collects intensity values at a frequency higher so that a plurality of said intensity values can be measured as a profile during the approach of the vehicle and the overlapping of the patterns. By the configuration of the patterns in figure 5 said intensity profile presents sequentially a first high intensity level, a decreasing portion and an increasing portion of intensity and then finally the first intensity level again. It is hence possible to brake the vehicle during the decreasing/increasing portions and to trigger the stop signal as the first intensity level is achieved again.

[0021] Figure 5 presents another advantageous feature which could be implemented on all other figures and systems according to the invention. In case that the patterns cannot be properly illuminated so that transparent regions of patterns don't let pass enough light to the unit of measurement, the system according to the invention may comprise a mean of pattern recognition (REC) with an input to an output signal of the unit of measurement (here the camera CAM) and with an output delivering the trigger signal (STOP) to a control unit (CT) for commanding a stop at a defined relative position between the vehicle and the platform and enabling an opening of the sets of doors. In case of pattern recognition with combined transmitted light or not, such pattern can provide other characteristics than opaque/transparency ones. For example, the first pattern TP1 can comprise some bright regions or some diodes like in figure 4 whose moving locations are accurately recognized in a region of interest of the camera. In that case the second pattern TP3 can only comprise transparent and opaque mask regions. By this way the amount of effective transmitted (illumination based) light to the unit of measurement or the amount of effective (from bright regions) received light by the unit of measurement is permanently guaranteed, because a lack of light transmission can be compensated by a further recognition of bright regions of said

first pattern.

Claims

1. System for managing an opening for a first and a second sets of automatically doors, the first set (DO1, DO2) belonging to a vehicle (V) and the second set belonging to a platform at the wayside (WS) of the vehicle, both sets of doors having to be positioned exactly in front of each others before a command of opening them is validated, **characterized in that** :
 - at least two doors, one of the first set and another of the second set to be positioned in front of each other, provide a transparency pattern on a part of their window, said at least one pattern (TP3) allowing to transmit an amount of light within and though its associated window,
 - a unit for measurement of said amount of transmitted light over said pattern is emitting at least one trigger signal as the vehicle approaches the platform, said trigger signal commanding a stop at a defined relative position between the vehicle and the platform and enabling an opening of the sets of doors.
2. System according to claim 1, for which the pattern comprises a transparency area with opaque boarders whose length is maximally equal to a width of a glass window of a door and whose width is at least equal to a portion of height of said glass window.
3. System according to claim 1, for which the pattern comprises a transparency area with opaque boarders whose height is maximally equal to a height of a glass window of a door and whose width is at least equal to a portion of width of said glass window.
4. System according to one of the claims 1 to 3, for which at least one of the pattern comprises a light coded transparency area.
5. System according to one of the claims 1 to 4, for which the unit of measurement comprises a line or an array light sensor, like a video camera, ideally located at the wayside or between the two sets of doors.
6. System according to one of the claims 1 to 5, for which a lighting mean is located closed to a first pattern for illuminating transparency area of said pattern and ensuring a sufficient amount of light to be measured by the unit of measurement.
7. System according to claim 6, for which the second pattern to be aligned in front of the first pattern pro-

vides transparency parts which are free of lighting means.

8. System according to one of the preceding claims comprising a mean of pattern recognition with an input to an output signal of the unit of measurement and with an output delivering the trigger signal to a control unit for commanding a stop at a defined relative position between the vehicle and the platform and enabling an opening of the sets of doors.

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FIG 1

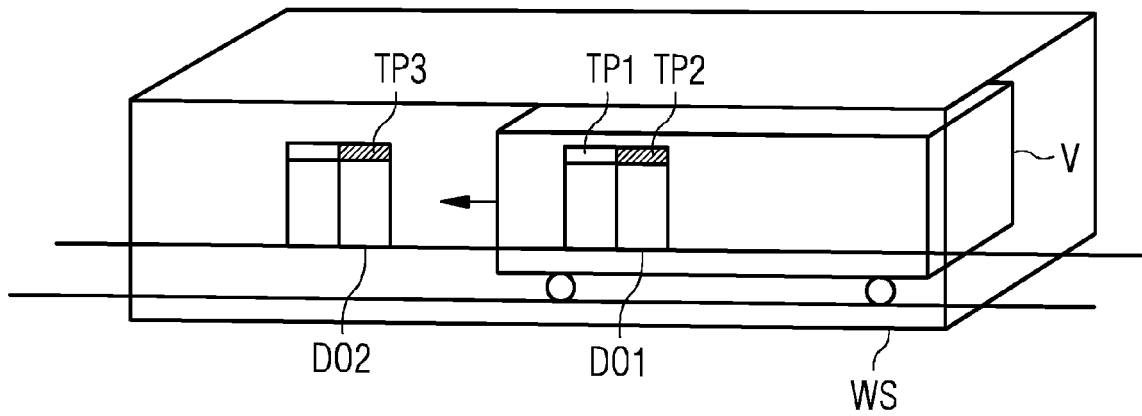


FIG 2

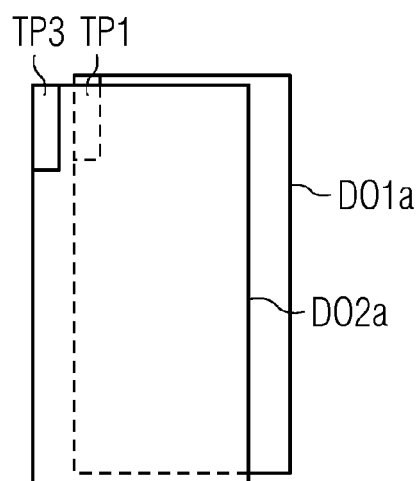


FIG 3

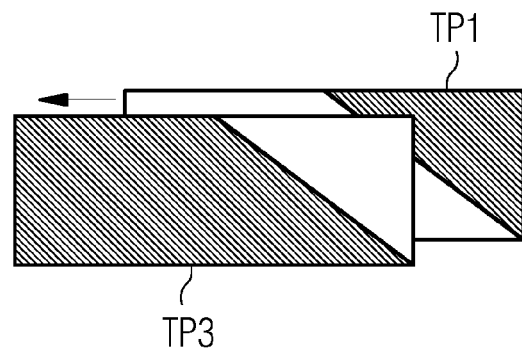


FIG 4

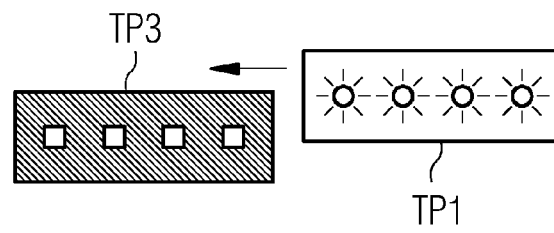
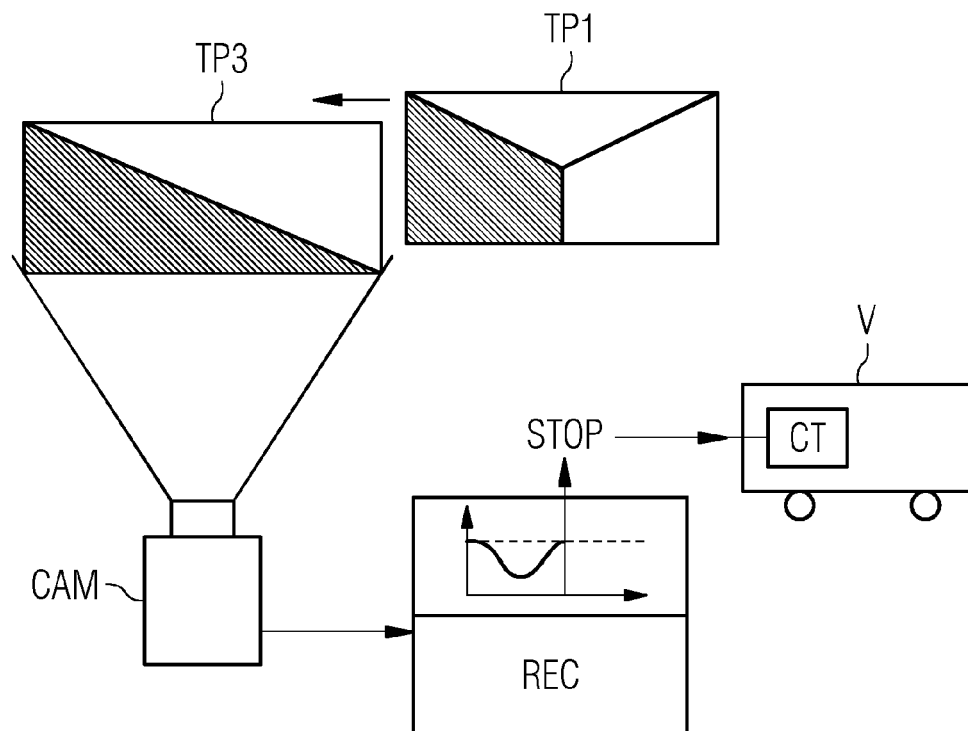


FIG 5





EUROPEAN SEARCH REPORT

Application Number
EP 11 29 0271

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 10 November 2011	Examiner Chlosta, Peter
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
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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