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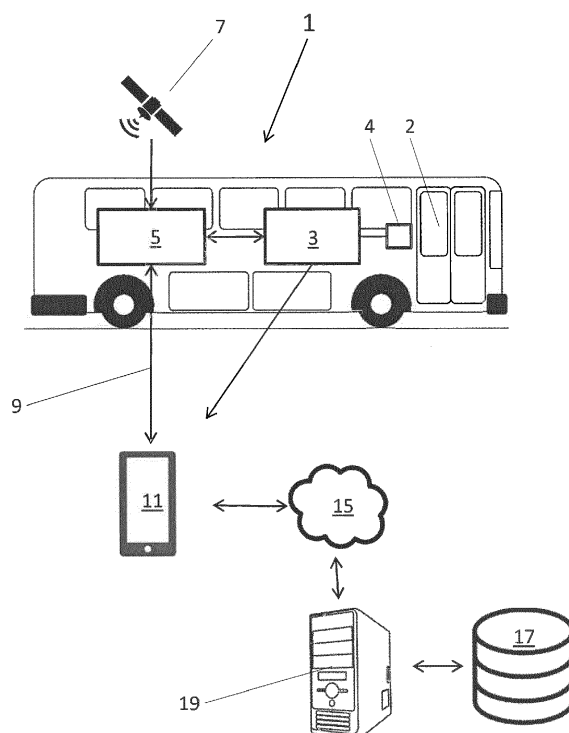
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(54) **SUPPORT DEVICE FOR LOCATING A DOOR OF A VEHICLE, RECEIVER THEREFOR AND OPERATING METHOD**

(57) An electronic switch (3) in a public transport vehicle (1) serves as a support device for persons suffering impaired physical or sensorial capabilities, in particular limited view or blindness, for operating the doors (2) of the vehicle (1). The switch (3) emits identification and optionally other data. The signal of the switch (3) which is arranged in close neighbourhood of the door (2) assigned to it, can be used to determine its distance from a receiver appliance (11) like a telecommunication appliance carried by a person. Furthermore, the signal can be used to request opening of the assigned door (2) and a stop of the vehicle (1). Preferably, the electronic switch (3) is capable to simulate a conventional signalling means like a push button (4) to request a stop and the opening of a door (2).



Description

[0001] The present invention relates to a support device according to the preamble of claim 1. It further relates to a receiver for cooperation with the support device, a transportation control system connected to a transportation vehicle comprising at least one support device, and methods using the support device.

[0002] In order to leave a public transport vehicle like a bus, it is common to press a push button or the like to alert the driver (or, in the future, the conducting system) that the vehicle shall stop and to indicate at which door a passenger is willing to leave the vehicle. As well, push buttons are normally arranged at the outside of the vehicle adjacent the doors so by pressing a button, a waiting passenger can open the door and enter the vehicle.

[0003] Obviously, persons suffering impaired physical or sensorial capabilities, for example reduced sight or blindness, have difficulties to find these push buttons and operate them.

[0004] These persons also have difficulties to locate the nearest door, or to find the vehicle which is headed to their travel destination, particularly in locations like larger bus stations where vehicles for different destinations stops.

[0005] The latter problem concerns as well people like tourists which use a certain transportation system the first time or only from time to time.

[0006] Therefore, an object of the present invention is to propose a support device in particular for persons suffering reduced capabilities to locate and identify a door of a public transportation means and to request that the door is opened with less problems.

[0007] Such a device is defined in claim 1. The further claims present preferred embodiments, receiver devices for cooperation with the support device, a transportation control system connected to transportation vehicles equipped with one or more support devices, and methods using the support device or any of the other embodiments or devices mentioned.

[0008] People, who the invention is addressed at, nowadays dispose of wireless communication means like a mobile phone specifically adapted to their needs. The present invention proposes means and methods to enable those persons to make use of their adapted communication means to locate and preferably to operate doors of public transportation vehicles, like buses, shuttles, ferries, or trains.

[0009] According to an aspect of the invention, near the means provided for opening a door like a push button, a support device is arranged which wirelessly emits a signal comprising a code or identifier. The signal may be received by the communication appliance. On request of the person carrying the communication appliance, it forwards the identifier to a door control device that this door shall be opened. Furthermore, the communication appliance may determine the distance from the support device or devices on the basis of the amplitude of the received

signal and also the direction toward it. With this information, it is capable to select the nearest support device and thereby the nearest door, as necessary also if the door is one of a vehicle of a desired destination, and to direct its owner toward this door.

[0010] The invention will be further explained by means of a preferred embodiment with reference to the Figure.

Figure 1 Schematic illustration of a transport control system.

[0011] In a public transportation vehicle 1, in the following called and exemplified by a bus, one or more (preferably all) doors 2 are equipped with an electronic door switch 3 (i.e. a support device). The switch 3 comprises an emitter for emitting an identifier of the door 2 assigned to the switch 3 and located nearby. The identifier is a data set which is sufficiently unique to avoid not only a confusion between switches 3 and doors 2 in the same vehicle 1 but also with doors of other vehicles which may closely pass. Preferably, the identifiers are unique for a whole transportation network, or simply worldwide.

[0012] Furthermore, the switch 3 comprises a relay or the like which is connected in parallel to the usual push button 4 for opening door 2. Its power supply may be autonomous, e.g. a pile, an accumulator, and/or an energy harvester which collects energy from the environment, e.g. electromagnetic radiation. Alternatively it may take its energy from the signal lines connecting the conventional door push button 4 with circuitry of bus 1. Since the introduction of Bluetooth low power, a wireless communication technique is available which allows designing an electronic door switch 3 of such a low power consumption that power supply by piles or from signal lines is feasible.

[0013] The electronic door switches 3 of a vehicle 1 are connected to a communication module 5 (or a number of communication modules) arranged in the vehicle 1. The communication modules 5 are provided with a GNSS module 7 (or more generally a module capable to determine the current location of the vehicle, called a "global positioning module"). The GNSS module determines the current position via a globally, or possibly only regionally or locally, available positioning system. The usually required antenna may be located at the vehicle that the positioning is not disturbed.

[0014] Furthermore, via wireless communication 9 (e.g. Bluetooth), the communication modules 5 can exchange data with telecommunication appliances 11 like a mobile or a smartphone, tablet, computer or another device provided with the required wireless communication interfaces and as required adapted by hardware and software to the needs of its owner. Currently, Bluetooth low energy is deemed best suited as the wireless telecommunication connection between the personal telecommunication appliance 11 and the devices in the vehicle 1, in particular communication modules 5 and electronic door switches 3.

[0015] By the described arrangement, the smartphone 11 (representing any telecommunication appliance as mentioned above in the following description), once provided with an appropriate piece of software, can detect and identify the switches 3 within the range of their emitters. In evaluating the amplitude of these signals, or by another method, e.g. comparing its own position with the positions of the switches 3, the smartphone 11 determines the nearest switch. A method to determine the distance between receiver and emitter is the RSSI (of Glossary) which is known per se. The smartphone 11 sends to the communication module 5 a request that the door assigned to the nearest switch 3 (or generally the switch selected by the software or manually by the user, i.e. for taking care of peculiar situation like obstacles, crowded people) is to be opened. The communication module will incite that switch 3 to provide the "open door" signal e.g. by simulating pressing the conventional push button 4. In consequence, the vehicle will be stopped at the next stop, and the door will open. Furthermore, the smartphone 11 may provide its owner information of the way to this door.

[0016] Regarding the situation of waiting for a bus 1, the smartphone 11 is capable to initiate the opening of the nearest door and to guide its owner towards the door.

[0017] Still, given the electronic switch 3 has positioning and movement data from the GNSS unit 7, the switch 3 can transfer these data to the smartphone 11 so that the user may be informed of position and direction.

[0018] The functionality is greatly enhanced if the smartphone has access to the internet 15 and therein a data base 17 exists which contains data like (bus etc.) line information, time schedule, identifier of transport vehicles and user identifiers. The database 17 is hosted on a computer 19 which is accessible by the Net. Computer 19 is representative for any arrangement of one or more computers for this purpose. Furthermore, the backend services may run on computer 19. These backend services handle the requests of the smartphones and other units of the system. The user identifiers may be bound to individual smartphones or to persons. Users or devices may be identified by creating accounts. An account comprises data relative to the user or device, and usually access credentials, like userid and password.

[0019] With these additional provisions, the smartphone can provide the following functions:

- The identifier of an electronic switch 3 can be transmitted to the data base 17 which responds with data identifying the vehicle and its heading. Given the situation of a person waiting at a stop of different lines, the smartphone 11 is capable to select a vehicle of a given line or destination.
- Particularly for requesting the opening of a door from outside a vehicle, the data base 17 can first check the user identifier if the request to furnish data is to be responded at all, i.e. if the user is authorized to request this action, or if it pertains to a person need-

ing particular care like a blind person. The data base 17 may provide different codes to be transmitted to an electronic switch 3, e.g. to inform the driver to take care of the approaching person.

- Inversely, the smartphone 11 may send the identifier of an approaching vehicle 1, i.e. a newly detected electronic switch 3, preferably accompanied by positioning data provided by the electronic switch 3 as well, to the data base 17. The data base 17 informs the smartphone 11 of details of that vehicle 1, particularly its heading, ancillary data like special installations for handicapped persons, or of points of interest. Used by tourists, the smartphone 11 may provide even informations on points of interest for the next or a particular transport vehicle in its course. Information may be vehicle stops, sightseeing tips, audio guides.

[0020] The following parameters are deemed particularly suited for the mentioned devices:

- Emission of identifiers by the electronic switches 3: 1 to 10 times per second.
- Range of the signal emitted by the electronic switches: at least about 5 m. However, Bluetooth allows ranges up to 150 m. The communication modules 5 may use corresponding strong signals as they are connected to the vehicles electric power source so that energy housekeeping is not an issue.

[0021] According to the description, the following advantages may be attained by the preferred embodiment:

- The users are permanently informed of the actual transport courses and time schedules, even including street works, interruption, modification of lines and times, traffic jams.
- Transmission of information to the users by their individually adapted communication device.
- The electronic switch for opening a door from the outside may be located in the interior for protection against damaging.
- A user may be informed of approaching vehicles, in particular the one she intends to use.
- It is no more necessary to search for a push button or the like for operating a door.

[0022] Based on the description set forth above, numerous modifications and additions are conceivable to the one skilled in the art without leaving the scope of protection which is defined by the claims.

[0023] Conceivable modifications and additions may be:

- The electronic switch 3 is connected in series with the conventional open-door push button in cases where the push button opens, i.e. intersects, when pushed.

- The electronic switch 3 is directly connected to the vehicle's signalling system to indicate a request to stop and/or to open the door. The connection may be by wire or wireless.
- Whereas the progress of a vehicle may be followed by a program running in the background on the telecommunication appliance 11, requesting the opening of a door, particularly from outside of a vehicle, is possible only if the program is running in the foreground, i.e. in a modus allowing interaction with the user.
- The electronic switch 3 emits an indicator of its current emission power. The telecommunication appliance 11 may use this information to normalize the measured signal strength to a standard emission power and to determine correctly the distance of different electronic switches, even if they use differing emission powers.
- The received and emitted identifiers of a support device or any device may not be the same. E.g. incited by reception of an identifier, device telecommunication appliance 11, data base 17, communication module 5, may transform it or replace it by other data serving the intended purpose. Hence, "identifier" may refer to any appropriate data or signal incited by occurrence of the original identifier. Such modification may be decryption, encryption, addition of a timestamp, etc.
- The database 17 contains e.g. vehicle management data (relationship between vehicle and line, etc.); time schedules; perturbation information; data of modules of the present invention, in particular their IDs, and the vehicle equipped; user data like access credentials, identification data etc.

Glossary

[0024]

- GNSS is a (global) positioning system like GPS, Glonass, or Galileo.
- RSSI (Received Signal Strength Indicator) is an indication of the power level being received by the antenna. $RSSI\ (dBm) = -20 \cdot n \cdot \log_{10}(d) + A$, d =distance in meters, A =received signal strength in dBm at 1 meter. The doubling of distance corresponds to decrease of RSSI for 6dB.
- Bluetooth Smart (known as Bluetooth low energy) was introduced with the Bluetooth 4.0 specification, and enables a new low power radio. Bluetooth smart enables ultra-low power connectivity and basic data transfer. Typical applications are remote controls, watches, sport equipment, health sensors, home automation, mobile advertising and indoor navigation.

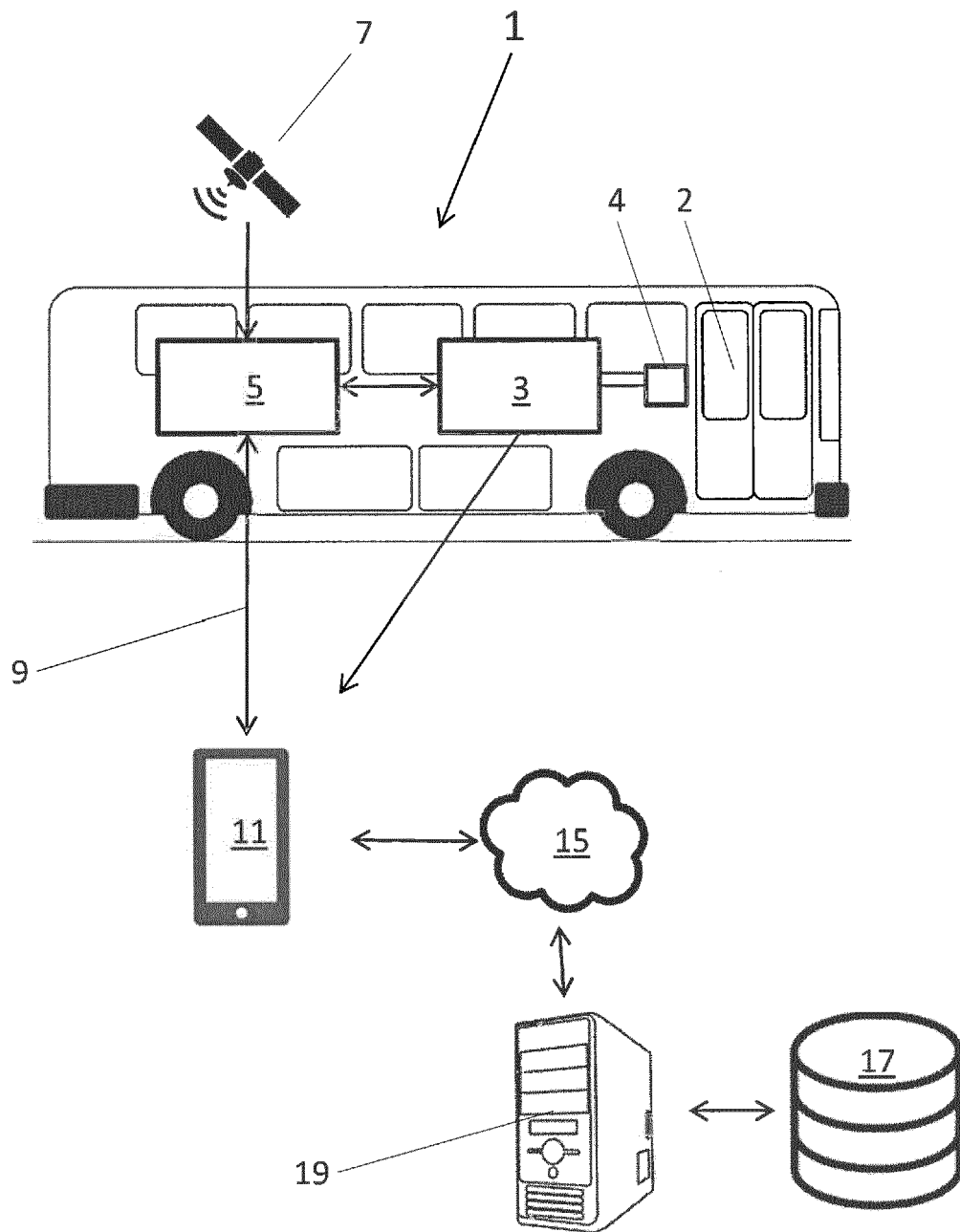
Claims

1. Support device (3) for locating a door of a public transportation vehicle (1) suited in particular for persons suffering impaired physical and/or sensorial capabilities, **characterized in that** the support device is arranged near a door (2) of the vehicle and comprises an emitter for wirelessly emitting a code identifying the device so that a receiver device (11) receiving the code is capable to inform a door control device (5) that the door near that support device shall be opened and to direct a person to towards the door.
2. Support device (3) according to claim 1, **characterized in that** the emitter is arranged to emit a signal according to a standardized wireless data transmission technique, preferably according to the low power Bluetooth standard.
3. Support device (3) according to claim 1, **characterized in that** the signal strength is at most -90 dBm in a distance of 5 m from the support device in order to limit de reception range.
4. Support device (3) according to claim 1, **characterized in that** the device comprises a receiver arranged for wirelessly receiving an activation signal and an door opening unit connected to a manual input device (4), in particular a push button, assigned to the door (2), the door opening unit being able to simulate an activation of the input device, so that on receipt of the activation signal by the receiver, operation of the input device can be simulated in order to open the door.
5. Receiver device (11) for cooperation with the support device (3) according to claim 1, **characterized in that** the receiver device is arranged to receive the code signal, is capable to determine the direction towards it and/or in case more than one support device is received, is capable to determine which is the nearest support device on the basis of the measured signal power.
6. Receiver device (11) according to claim 5, **characterized in that** the receiver device is a portable computerized device, in particular a smart phone, capable to load software to detect and decode the signal of the support device (3).
7. Receiver device (11) according to claim 5, **characterized in that** the receiver device comprises a transmitter-receiver unit and related software capable to execute a data exchange protocol with external devices, in particular the Bluetooth protocol.
8. Public transportation vehicle (1), in particular a bus, comprising at least one, preferably at least two doors

(2) equipped with a support device (3) according to claim 1,

9. Transportation control system connected to at least one transportation vehicle (1) comprising a support device (3) according to claim 1, so that on receipt of a request signal, the request signal containing an identifier identifying the support device, the control system is capable to open the door (2) assigned to the support device. 5 10
10. Transportation control system according to claim 9, **characterized in that** the control system comprises a data base (17) of identifiers of authorized identifiers, the request signal comprising an identifier of the receiver device (11) and the identifying code of the support device (3), so that the control system is capable to determine that the receiver device is authorized to open the door by determining if the identifier of the receiver is stored in the database. 15 20
11. Method for opening a door (2) next to a person in a public transportation vehicle (1), in particular a bus or train, **characterized in that** a support device (3) located near the door emits periodically an identifying code, a receiver device (11) carried by a person receiving the identifying code transmits it together with a user identifier to a transport control system comprising a data base (17), the database containing at least the support device identifier and data identifying the vehicle provided with the support device, and the control system sends a signal to the vehicle which contains the support device if it determines that the support device identifier is contained in the data base, the signal being a request to open the door (2) assigned to the support device. 25 30 35
12. Method according to claim 11, **characterized in that** the receiver device (11) determines the support device (3) nearest to it by comparing the signal amplitude of the signals received from more than one support device and transmits the identifying code of the support device of highest amplitude determined to the control system so that the nearest door (2) will be opened. 40 45
13. Method according to claim 11, **characterized in that** the control system sends a confirmation signal to the receiver device (11) that the door (2) identified will be opened, and the receiving device informs the person carrying it of the way to the door. 50

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EUROPEAN SEARCH REPORT

Application Number
EP 16 15 0543

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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	FR 2 971 353 A1 (PHITECH [FR]) 10 August 2012 (2012-08-10) * abstract * * * figure 1 * * page 2 - page 7 *	1-10	INV. G07C9/00
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A	US 2004/066315 A1 (SZULANSKI SERGIO OSCAR [AR]) 8 April 2004 (2004-04-08) * abstract * * * paragraph [0031] - paragraph [0067] * * figures 1-2c *	1-10	TECHNICAL FIELDS SEARCHED (IPC) G07C A61F A61H G09B G01C G01S
3 The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 12 July 2016	Examiner Pañeda Fernández, J
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			

EPO FORM 1503 03.82 (P04C01)



Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-10

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



LACK OF UNITY OF INVENTION
SHEET B

Application Number

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-10

Support device for locating a door of a public transportation vehicle suited in particular for persons suffering impaired physical and/or sensorial capabilities, the support device being arranged near a door of the vehicle and comprising an emitter for wirelessly emitting a code identifying the device so that a receiver device receiving the code is capable to inform a door control device that the door near that support device shall be opened and to direct a person to towards the door. Receiver device.

2. claims: 11-13

Method for opening a door next to a person in a public transportation vehicle, in particular a bus or train, characterized in that a support device located near the door emits periodically an identifying code, a receiver device carried by a person receiving the identifying code transmits it together with a user identifier to a transport control system comprising a data base, the database containing at least the support device identifier and data identifying the vehicle provided with the support device, and the control system sends a signal to the vehicle which contains the support device if it determines that the support device identifier is contained in the data base, the signal being a request to open the door assigned to the support device.

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

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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12-07-2016

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