Case 1798

METHOD AND SYSTEM FOR DETECTING INDIVIDUALS OR OBJECTS IN A DELIMITED SPACE HAVING AN ENTRANCE

The present invention concerns the detection of individuals or objects in a delimited space having at least one entrance. More particularly, the present invention concerns the detection of the presence of individuals or objects in a delimited space during a time period following the passage through the entrance of said individuals or objects. " Entrance " means in a broad sense any door or pathway giving access to the delimited space in question. By way of example, the presence of individuals may be detected during a trip on public transport or at a sporting or cultural event taking place in a delimited space.

In the case of the present invention, the presence of individuals or objects is detected by means of portable electronic cards or units having means for receiving first data in the form of electromagnetic signals and means for supplying second data also in the form of electromagnetic signals. The individuals or objects are provided with such portable electronic units.

In order to determine the presence of an individual or object in a delimited space at a given time, it is often not enough to detect him or it passing in proximity to an entrance to such space. It will be noted that certain individuals or objects momentarily located in proximity to an entrance may enter into communication with an aforementioned transmitter or transceiver located at said entrance which, in the absence of other appropriate means, will consider that the individual or object in question has entered said space. This conclusion may prove erroneous given that an individual or object may be momentarily in proximity to an entrance of a delimited space without entering it. Moreover, it is also possible that a person enters for a moment and then comes out again before a determining event, for example the start of a film or closure of the doors on public transport. Depending upon the arrangement of the transmitter or transceiver provided at the entrance, it is not possible to guarantee that the individual's or object's exit prior to the determining event is properly recorded and thus uncertainty remains as to his or its presence in said limited space after said determining event.

Generally, the invention proposes to overcome the aforementioned drawbacks by arranging inside the delimited space one or more receivers or readers capable of entering into communication with the portable electronic units present in this space after a determining event, for example between two stops or stations in the case of public transport.

However, an important problem remains given that communication from a middle distance, in particular of the order of magnitude of meters or tens of meters, is

practically only possible at a relatively high frequency, for example of the order of hundreds of MHz. In order to keep the electronic receiver circuit of a portable electronic unit in listening mode, i.e. in a state able to receive a coded electromagnetic signal, the power consumption is relatively important and requires a power source of relatively high capacity, which is difficult to integrate in an electronic unit intended to be worn or carried by an individual. Given that for numerous applications, it is necessary for the receiver of the portable electronic unit to be able instantaneously and permanently to receive a coded signal, the fact of providing receivers or transceivers in said delimited space is not sufficient in itself for a functional system when the delimited space in question has at least a dimension of the order of a meter or ten meters.

The particular object of the present invention is thus to overcome the aforementioned problem by proposing a method for detecting an individual or an object in a delimited space defined in independent claim 1 annexed hereto.

The present invention also concerns a system for detecting individuals or objects in a delimited space having at least one entrance as defined in independent claim 5 and a card or electronic unit forming a transceiver or receiver-responder as defined in independent claim 14.

As a result of the features of the detection method according to the invention, and to the corresponding features of the detection system according to the invention allowing said detection method to be implemented, and the corresponding features of the electronic unit according to the invention associated with said detection system, the receiving means arranged in said electronic unit remain permanently or quasi-permanently in a listening mode, at least during relatively long periods in the event that interrupting means are provided, while consuming relatively little power given that they are arranged to operate at a low frequency. This advantageous arrangement is made possible by the fact that the portable electronic unit receives first data at a low frequency when someone or something passes through an entrance to the delimited space which allows short distance and thus low frequency communication, and by the fact that the electronic part of these portable electronic units operating at a high frequency is essentially activated only for one or several limited moments during which high frequency communication is provided, at a certain frequency or within a frequency range, with the receiver(s) or reader(s) provided inside said space.

In a preferred embodiment, said first data provided at a low frequency include a delay signal defining a time interval between reception of these first data and activation of the high frequency electronic circuits, in particular means for supplying the second data to the aforementioned receiver or reader. Consequently, a determining event may take place between reception of the first data by the portable

electronic unit and the high frequency communication, during a limited activation moment, between this unit and a receiver or reader provided inside said space. This determining event is for example the closing of the doors on public transport means prior to the departure thereof.

The present invention thus allows the presence of individuals or objects in a delimited space during a given time period to be detected with great efficiency while minimising the power consumption necessary to keep the portable electronic unit associated with an individual or an object in a listening mode allowing instantaneous and permanent communication, necessary for communication at an undetermined moment with a detection transmitter or transceiver.

Particular embodiments and other advantages of the present invention will become clear upon reading the following description made with reference to the annexed drawings given by way of non-limiting examples, and in which:

- Figure 1 shows a train carriage fitted with a first embodiment of a detection system according to the present invention;

- Figure 2 shows schematically a first embodiment of a transceiver or transmitter-responder forming a portable electronic unit according to the invention associated with the system of Figure 1;

- Figure 3 shows schematically a top view of a metro or bus compartment fitted with a second embodiment of a detection system according to the present invention;

- Figure 4 shows a second embodiment of a portable electronic unit according to the invention associated with the system of Figure 3; and

- Figure 5 is a similar view to Figure 3 and shows an improved variant of the detection system according to the invention.

The detection system and method according to the invention will be described hereinafter for an application concerning the transport of people, in particular by train (Figure 1) and by metro or bus (Figure 3). Of course any other means of transport, in particular road or air transport may be envisaged for individuals or objects. It will be noted here that the field of application of the present invention is not limited to transport but also concerns fixed limited spaces, in particular waiting rooms in airports, and following up the movement of an object or an individual in a private or public building, in particular a company.

With reference to Figures 1 and 2, a first embodiment of the detection system according to the invention will be described allowing a first implementation of the method according to the invention. Carriage 2 is fitted with two transmitters 4 and 5 located respectively at two entrances 6 and 7 allowing access to an inner space 10 of

carriage 2. According to the variant shown, two receivers or two readers 12 and 13 are arranged inside the carriage.

" Receiver " means in listening mode arranged to receive coded signals at a certain frequency or within a given frequency range. " Reader " further means that the latter is arranged to send interrogation signals used to control communication with a responder.

It will be noted first that for the requirements of the present invention, in the event that a single entrance is provided for the delimited space being monitored, a single transmitter and a single receiver or reader placed in a central position inside inner space 10 may be sufficient. However, depending upon the dimensions of the delimited space being monitored, the use of several receivers or readers may prove preferable.

Transmitter 4 includes low frequency transmitting means, in particular of the order of one hundred kHz, arranged to provide first data to a portable electronic card or unit 16 forming a transceiver or receiver-responder shown schematically in Figure 2. Transmitter 4 or 5 thus provides first data to every electronic unit 16 which enters its communication field. According to the invention, the low frequency receiving means 18 of this unit 16 are permanently or quasi-permanently in a " listening " mode, in any event during the operating periods provided for electronic unit 16. For this purpose, low frequency receiving circuit 18 is powered by a power source 24 arranged in unit 16. This unit also includes a high frequency transmitter or responder circuit 20, in particular of the order of hundreds of MHz or more, for supplying second data to receiver or reader 12 or 13 at an instant following the passage through entrance 6 of individual 8 carrying electronic unit 16. These second data are transmitted at a high frequency, either at a given frequency or within a determined frequency range. Indeed, the communication frequency may vary from one message to another and also during transmission of the same message in accordance with the spread spectrum method.

The second data are stored in a memory 22 connected to circuit 20. In a first variant, the transmission of the second data by circuit 20 is effected via inner power source 24. In this case, a simple receiver 12 or 13 is sufficient for the present detection system. However, in a preferred variant, the data supplied by circuit 20 is transmitted by modulating an excitation field provided by reader 12 or 13. In a variant of this preferred embodiment, a part of the energy of the excitation field may also be supplied to circuit 20 to power it and using the excitation field to recharge power source 24 may also be envisaged.

According to the invention, high frequency circuit 20 is activated only in one or more limited moments occurring after reception of said first data by low frequency

receiver circuit 18. Reception of this first data determines at least the start of a first limited activation moment of circuit 20. Said second data is provided with a certain delay relative to the reception by unit 16 of said first data, since the presence of an individual or object inside a delimited space is detected after a certain period of time following its passage through the entrance, in particular only after entrances 6 and 7 have been closed. In a preferred variant, circuit 20 is activated only after a certain first time interval following reception of said first data and determined by a delay signal contained in said first data. For this purpose, a time base 26 is provided, used to count a time interval or to count down said interval in order to determine the start of a first limited activation moment of circuit 20. Receivers or readers 12 and 13 are activated at least during said one or more limited moments.

Electronic unit 16 includes two antennas 28 and 30 respectively associated with two circuits 18 and 20 and respectively adapted to a low frequency and a high frequency communication.

With reference to Figures 3 and 4, a second embodiment of a detection system according to the invention will be described, allowing a second implementation of the method according to the invention.

The references already cited previously within the scope of Figures 1 and 2 will not be described again in detail here. Metro or bus compartment 32 defines a space 10 inside which an individual 8 may enter through a single entrance 6. This entrance is closed by a sliding door 34. Individual 8 enters compartment 32 provided with an electronic card or unit 36 shown schematically in Figure 4.

According to this second embodiment, in addition to the two receivers or readers 12 and 13, two high frequency transmitters 38 and 39 are arranged in space 10. Preferably, the communication frequency of the transmitters is the same as that of the aforementioned receivers or readers with which they may be associated to form two high frequency communication units.

In a preferred variant of the second implementation of the method, transmitters 38 and 39 send to electronic units 36 present in space 10 at least one reactivation signal determining a new time interval after which high frequency receiving circuit 42 has to be activated again for a limited moment following the limited moment during which the reactivation signal is received. In order to be able to receive third data containing at least said reactivation signal, circuit 42 is also activated during each limited moment when circuit 22 is activated.

The method described hereinbefore in particular allows the presence of individuals provided with electronic cards or units 36 in space 10 to be monitored at successive moments separated in time. In the case of a train or another form of public

transport, the presence of individuals between each successive stop will be detected. This method is advantageous in that it requires high frequency part 46 of unit 16 to be powered only for a single limited moment. In the event that no communication is established during this limited moment, high frequency part 46, in particular circuit 20 will not be activated again. Thus, maximum energy saving is guaranteed.

However, in an alternative embodiment, it is possible for the first data supplied to the entrance at a low frequency to determine several different time intervals corresponding to several limited moments during which circuit 20 has to be activated. This solution has the drawback of fixing the high frequency communication moments. Thus, in the event of delay or disruption to traffic, the moments of detecting the presence of individuals may not be synchronised with the different successive stops provided.

According to an alternative implementation of the method according to the invention, transmitters 38 and 39 are also used for an anti-collision protocol for communication between the set of cards or units 36 present in space 10 and receivers or readers 12 or 13. Those skilled in the art know different anti-collision protocols, in particular certain ones wherein an end of communication signal is sent to each card or unit 36 correctly detected.

Unit 36 further includes an electronic processing circuit and a memory forming unit 44. This unit 44 is connected to high frequency part 46 and may also be connected to low frequency part 48 of unit 36. Moreover, unit 44 is connected to time base 26 to control the measurement of the various time intervals involved in the method according to the invention.

Power source or accumulator 24 powers part 48 and also part 46 in said limited moments during which high frequency communications occur. In order to schematise the fact that high frequency part 46 is essentially activated during determined limited moments, source 24 is connected to a switch 50 controlled by time base 26. Switch 50 may also be controlled via unit 44.

According to an improved variant of the second implementation of the system of the invention, two low frequency receivers or readers 54 and 54 are arranged at entrance 6. Preferably these receivers or reader form respectively two low frequency communication units with transmitters 4 and 5. It will be noted that transmitters 4 and 5 in Figure 3 are placed on either side of entrance 6 while they were respectively placed at two entrances in Figure 1. Receivers or readers 54 and 55 are used in particular for receiving identification codes allowing the individuals or objects entering space 10 to be identified. For this purpose, electronic units 36 include a low frequency transmitter circuit 56 arranged in part 48 connected to unit 44 in which the identification code is

recorded. This may serve as means of security and also be used for controlling the detection protocol for units 36 present in space 10. In particular, in the event of non-detection of one of the identification codes, a new interrogation may be provided either immediately, or after a short time interval in order to ensure that the individual or object carrying the unit 36 corresponding to this identification code is actually absent from space 10.

Finally, Figure 5 shows another improved variant of the detection system according to the present invention. The references already described here with reference to Figure 3 will not be described again here. This variant differs from that of Figure 3 essentially in that in addition to transceivers 4, 54 and 5, 55, two readers or transceivers 58 and 59 are also provided. The latter have communication regions 60 and 61 which are partially spatially separated from communication regions 62 and 63 of transceivers 4, 54 and 5, 55.

This variant allows the direction of passage in entrance 6 to be easily detected, i.e. the entry or exit of an individual or object to be detected. This enables detection control inside the space 10 being monitored to be reinforced, and also allows the power consumption of units 36 to be optimised. During an entry, the old time data for activating high frequency part 46 are deleted and new instructions are stored. During an exit, the remaining instructions concerning limited subsequent activation moments of part 46 may for example be cancelled. Thus, this high frequency part will not be activated unnecessarily once the individual or object has left space 10.

In a proposed variant, transceivers 58 and 59 communicate at a low frequency, preferably at the same frequency as transmitters 4 and 5.

CLAIMS

1. Method for detecting at least an individual (8) or object in a delimited space (10) having at least one entrance (6, 7) through which said individual or object has access to the space, this method including the following steps:

A) reception by an electronic card or unit (16; 36) forming a transceiver or receiver-responder, carried by said individual or object, of first data supplied by a first transmitter (4, 5) placed at said entrance, in a first frequency range, said electronic unit including first receiving means (18) within said first frequency range capable of permanently or quasi-permanently being in listening mode;

B) activation of second means (20), arranged in said electronic unit, to supply second data essentially during one or more limited moments of which at least the beginning of said one or one of said limited moments is determined by said first data received by said electronic unit, said second data being supplied within a second frequency range higher than said first frequency range and being received by at least a first receiver or reader (12, 13), placed in said space and which is activated at least during said one or one of said limited moments, said second data being supplied with a delay relative to the reception of said first data so as to detect whether said individual or object is present in said space after a certain period following his or its passage through said entrance.

2. Detection method according to claim 1, characterised in that said first data include a delay signal determining a first time interval between reception of the first data and said beginning of said first limited moment.

3. Method according to claim 1 or 2, characterised in that, when said first receiver or reader receives second data from said portable electronic unit, a reactivating signal is sent to said receiver or reader by a second transmitter (38, 39) placed in said space, this reactivating signal determining a time interval after which said second means are again activated during a limited moment subsequent to the limited moment during which said reactivating signal is received, said portable electronic unit including for this purpose third reception means (42) within said second frequency range.

4. Method according to any of the preceding claims, characterised in that at step A) a second receiver or reader (54, 55) placed at said entrance receives, when said individual or object passes through said entrance, at least an identification code supplied by said electronic unit which includes for this purpose fourth means (56) for supplying fourth data to said second receiver or reader.

This Sheet Has Been Replaced



5. System for detecting individuals or objects in a delimited space (10) having at least one entrance (6. 7) through which individuals or objects have access to said space, this system including at least a first transmitter means (4, 5) placed at said entrance and associated with portable electronic cards or units (16, 36) forming transceivers or receiver-responders, said electronic units being arranged to receive first data via said first transmitter and intended to be carried by said individuals or objects, this system being characterised in that at least a first receiver or reader (12, 13) placed inside said space and arranged to receive second data supplied by said electronic units located in at least a part of said space, said first transmitter transmitting within a first frequency range and said first receiver or reader receiving said second data in a second frequency range higher than said first frequency range, each electronic unit having first means (18) for receiving said first data, capable of being permanently or quasi-permanently in " listening " mode, and second means (20) for supplying said second data which are activated only during one or more limited moments, at least the beginning of said first limited moment following the passage of said electronic unit through said entrance is determined by said first data, said second data being supplied with a certain delay relative to reception of said first data so as to detect the individuals present in said at least one part of said space after a certain period following their passage through said entrance

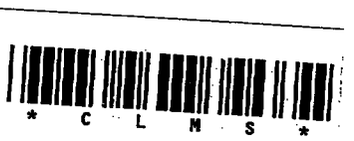
6. System according to claim 5, characterised in that said first data supplied by said first transmitter (4, 5) to said electronic units when they pass through said entrance include a first delay signal which determines a time interval between reception of said first data and the beginning of said first limited activation moment of said second means (20) said electronic units including a time base (26) allowing said first time interval to be counted or counted down.

7. System according to claim 5 or 6, further comprising a second transmitter (38, 39) in said second frequency range placed in said limited space and associated with third receiving means (42) in said second frequency range which are arranged in said electronic units, said second transmitter transmitting third data capable of being received by said electronic units, located in at least a part of said space, during said one or said limited moments.

8. System according to claim 7, characterised in that said third data received during any of said limited moments include a reactivation signal determining a time interval after which said second means are again activated during a limited moment subsequent to the limited moment during which said reactivation signal is received.

This Sheet Has Been Replaced





9. System according to claim 7 or 8, characterised in that an anti-collision protocol is provided for the transmission of the second data by the electronic units to said first receiver or reader (12, 13), this latter being associated to said second transmitters and said third data being used at least partly for implementing said anti-collision protocol.

10. System according to any of claims 5 to 9, characterised in that it includes a second receiver or reader (54, 55) located at said entrance and associated with fourth means (56) arranged in said electronic units for supplying fourth data to said second receivers or readers, in particular identification codes of the electronic units passing through said entrance.

11. System according to any of claims 5 to 10, characterised in that a third receiver or reader (58, 59) is also provided, located at said entrance, the respective communication regions of said second and third receivers or readers being at least partially separated spatially so as to allow the direction of passage of the electronic units to be determined, i.e. either an entry or an exit from said delimited space.

12. System according to any of claims 5 to 11, characterised in that said first frequency range is in the low frequencies, in particular of the order of one hundred kHz, and in that said second frequency range is in the high frequencies, in particular of the order of hundreds of MHz and more.

13. System according to any of claims 5 to 12, characterised in that said delimited space is a carriage, a compartment of a road vehicle or any other loading space of means for transporting people or objects, this system then being used for checking the people or objects occupying said space during a trip or given time period.

14. Electronic unit (16, 36) forming a transceiver or receiver-responder, in particular in the form of a card, including:

- first means (18) for receiving first data in a first frequency range and capable of being in listening mode permanently or quasi-permanently, at least during operating periods of said unit;

- second means (20) for supplying second data in a second frequency range higher than said first frequency range, these second means being capable of being activated only during one or limited moments of which at least the beginning of said one or one of said limited moments is determined by said first data.

15. Electronic unit according to claim 14, characterised in that said first frequency range is in the low frequencies, in particular of the order of one hundred KHz, and in that said second frequency range is in the high frequencies, in particular of the order of hundreds of MHz and more.

This Sheet Has Been Replaced



16. Electronic unit according to claim 14 or 15, characterised in that it further includes a time base (26) allowing a time interval given by the reception of a delay signal, a reactivation signal or any other time signal, to be counted or counted down, said electronic unit being arranged to activate said second means at the end of said time interval.

17. Electronic unit according to claims 14 to 16, characterised in that it further includes third receiving means (42) in said second frequency range, these third means being capable of being activated only during one or more second limited moments occurring after reception of said first data.

18. Electronic unit according to claim 18, characterised in that said second and third means (20, 42) have in common a coil (30) for transceiving electromagnetic signals.

19. Electronic unit according to any of claims 14 to 18, characterised in that it includes fourth transmission means (56) in said first frequency range, said first and fourth means (18, 56) having in common a second coil (28) for transceiving electromagnetic signals.

20. Electronic unit according to any of claims 14 to 19, characterised in that it includes a power source or energy accumulator (24) for powering at least said first means (18) so as to leave said first means permanently or quasi-permanently in a listening mode, at least during said operating periods.

This Sheet Has Been Replaced