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(54) A system for managing a plurality of vehicles

(57) A system (2) for managing vehicles which are to perform a service within a territory including a plurality of reference locations comprises a device (14) for receiving data signals and for supplying signals received, which carry a datum identifying a vehicle and a datum relating to the availability of the vehicle in a reference location. The system futher comprises a database and processing means for making available output signals carrying a datum relating to the state of occupation of the location and identification and priority data relating to the vehicle in the location.

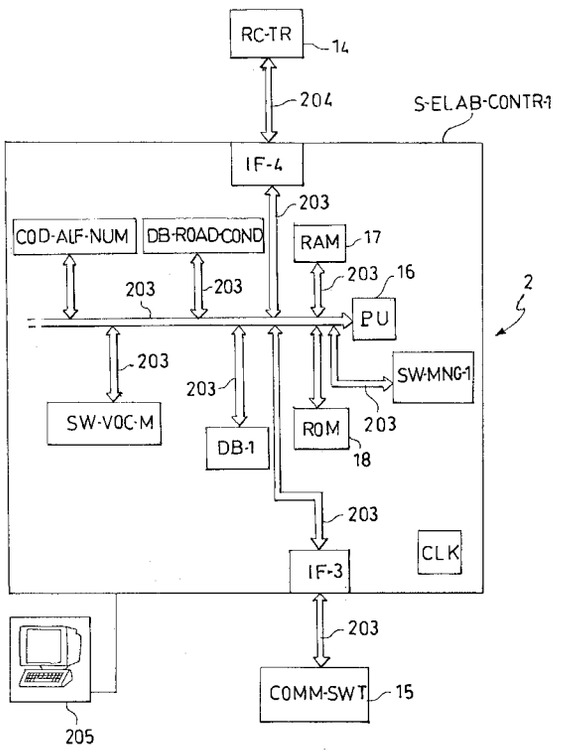

FIG.3

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Description

[0001] The present invention relates to a system for managing a plurality of vehicles which are to provide a service such as, for example, the transportation of people or goods within a territory. The present invention relates particularly, but not exclusively, to a system for managing a taxi service.

[0002] A taxi service is generally managed by a plurality of people (operators, cooperatives, etc.) who operate in a common territory and who have available taxi ranks or parking areas indicated by suitable notice boards.

[0003] The efficiency and competitiveness of a taxi service is closely correlated, amongst other things, with the period of time which elapses on average between the moment at which a user requests a taxi and the moment at which the requested taxi reaches the user.

[0004] This period of time is determined to a large extent by the ways in which a taxi can be requested and found.

[0005] Currently, as well as being able to look for a free taxi passing in the street, the user is offered two different methods.

[0006] The first method provides for the user to communicate telephonically with taxi-drivers who are in a taxi rank suitably provided with a fixed telephone (a telephone post). The user thus speaks to the taxi-driver directly, specifying the address at which he wishes to be reached.

[0007] It is pointed out that, since taxi ranks respond to different telephone numbers, it is not possible for the user to know beforehand in which taxi ranks operating taxis are present. The search for a taxi may therefore require several attempts by the user and may lead to the selection of a taxi rank which is not optimal from the point of view of the time required for the taxi to reach the user.

[0008] The second method provides for telephonic communication between the user and a suitable call centre the personnel of which arrange to find (for example, by means of radio links) the free taxi which should take the least time to reach the user at the address indicated.

[0009] It is pointed out that, according to this method, the user may wait for fairly long periods of time before the operator of a call centre can confirm that an available taxi has been found. Moreover, the assessment of the time taken to reach the customer is based, in this case, exclusively on the taxi-driver's statements and may therefore not have the necessary accuracy.

[0010] With the conventional methods, the user may therefore be faced with lengthy and expensive telephone calls as well as long waiting times.

[0011] There are also problems relating more directly to the operators of the service, that is, the taxi-drivers. In fact, for the taxi-drivers, there is a problem which is due to the fact that the currently known methods cannot evaluate sufficiently accurately the waiting times in a taxi rank and hence the priority acquired by one taxi-driver relative to his colleagues.

[0012] A further disadvantage of the methods currently in use consists of the fact that taxi drivers are not supplied with information relating to the state of occupation of the various taxi ranks within the territory in which they operate. As a result, the distribution of the available taxis over the territory does not coincide with the distribution. of the demand for the taxi service and, once again, this causes lengthy waiting times by the user as well as long journeys by the taxi-driver.

[0013] The object of the present invention is therefore to propose a system for managing a plurality of vehicles which overcomes the above-mentioned problems.

[0014] This object is achieved by means of a system defined by Claim 1.

[0015] Further subjects of the present invention are a telecommunication device and a telematics network which can be used for the control of vehicles and which offer a service to a plurality of users within a territory.

[0016] The characteristics and the advantages of the present invention will be understood further from a reading of the following detailed description of non-limiting embodiments thereof, illustrated in the appended drawings, in which:

Figure 1 shows schematically a telematics system for managing a plurality of vehicles according to a particular embodiment of the invention,
Figure 2 shows schematically an embodiment of a local node of the telematics system,
Figure 3 shows schematically an embodiment of a main node of the system,
Figure 4 shows schematically an embodiment of a communication apparatus which can be associated with a vehicle operating within the system,
Figure 5 shows schematically an embodiment of a table which can be stored in a database associated with the main node,
Figure 6 shows, schematically and by means of a flow chart, a particular method of operation of the system.

[0017] Figure 1 shows a telematics network or system 1 for managing a plurality of vehicles 5. In particular, reference will be made by way of example in the following description to the management of taxis 5.

[0018] The telematics system 1 comprises a main node including a main management system 2 and one or more local nodes including respective local telecommunication devices 3. The main management system 2, hereinafter referred to as the main system 2, can be connected to the local telecommunication devices 3 by connection means suitable for the transmission of signals (for example, free space, telephone lines, or optical fibres), represented by broken lines 200 in the drawing.

[0019] The taxis 5 operate within a territory 4, for ex-

ample, a city, including a plurality of reference locations 6. The reference locations are, for example, taxi ranks 6 for the taxis 5.

[0020] The local telecommunication devices 3, hereinafter referred to as local devices 3, are distributed over the territory 4 and are advantageously disposed in the taxi ranks 6.

[0021] Each local telecommunication device 3, hereinafter referred to as a local device 3, is an apparatus which is disposed, for example, in each taxi rank 6 and can detect the entry and exit of the individual taxis 5 to/from the taxi rank 6 and can communicate these "entry/exit" events to the main system 2.

[0022] A particular embodiment of a local device 3 is shown by means of functional blocks in Figure 2.

[0023] The local device 3 comprises a local RC-TR communication apparatus 9, a secondary processing and control system S-ELAB-CONTR-2, and a secondary TR-RC communication apparatus 11.

[0024] The local communication apparatus 9 comprises a receiver device for receiving or detecting data signals which are transmitted by suitable apparatus associated with the taxis 5 and can be detected when the taxis are in the corresponding taxi rank 6. The local communication apparatus 9 is also such as to supply, at a port 202, signals received, obtained from the data signals detected.

[0025] For example, the signals received which are supplied to the output 202 are digital electrical signals carrying a datum identifying the taxis 5 which are present in the taxi rank 6 and which are therefore available to perform the service.

[0026] The local communication apparatus 9 advantageously also comprises transmission means for transmitting interrogation signals to the taxis 5.

[0027] The local communication apparatus 9 may be a conventional short-range apparatus such as, for example, a radio-frequency device (for example, in accordance with the Bluetooth standard), or a receiver of infra-red light or acoustic signals. Moreover, in order to detect the presence of a taxi 5 in the taxi rank 6, the communication apparatus 9 may be formed by a video camera or television camera for suitable reading of symbols or "patterns" with which the taxis 5 are provided (for example, bar codes).

[0028] The range covered by the local communication apparatus 9 is preferably correlated with the size of the taxi rank 6. In this connection, the local communication apparatus 9 may advantageously be provided with a radio-modem card of known type having an adjustable range and operating at a frequency permitted by the legal norms and equal, for example, to 2.4 GHz.

[0029] The secondary processing and control system S-ELAB-CONTR-2 is suitable for receiving the digital electrical signals output by the port 202 of the local communication apparatus 9 and for processing them. In particular, the secondary processing and control system S-ELAB-CONTR-2 is such as to make available at an output of its own (such as, for example, an interface unit IF-2), for example, signals which carry the identification data of the taxis 5 which are in the specific taxi rank 6 and a datum identifying the taxi rank 6. The secondary processing and control system S-ELAB-CONTR-2 can also make available at an output of its own signals which, in addition to the datum identifying the taxi rank 6, also carry a datum correlated with the "entry/exit" event relating to a taxi 5 and the respective identification datum.

[0030] The secondary processing and control system S-ELAB-CONTR-2 also enables interrogation signals to be transmitted to the local apparatus 9 (to be retransmitted thereby to the taxis 5) and can generate signals for controlling and driving the apparatus 9 and the secondary communication apparatus 11.

[0031] The secondary processing and control system S-ELAB-CONTR-2 is connected to the port 202 of the local communication apparatus 9 and is connected to the secondary communication apparatus 11 by suitable connection means 201 such as, for example, data buses.

[0032] The secondary processing and control system S-ELAB-CONTR-2 may be formed by a programmable operating and control unit, preferably a microcomputer such as, for example, a personal computer PC, or by other suitable processing means.

[0033] Figure 2 shows a particular embodiment of the secondary processing and control system S-ELAB-CONTR-2 illustrated by means of blocks representing modules which may be of the software and/or hardware type. The secondary processing and control system S-ELAB-CONTR-2 comprises a processing unit PU, 10, a working memory 101, typically a RAM (random-access memory), a read-only memory 102 (a ROM), a first interface unit IF-1 for interfacing with the local communication apparatus 9 and a second interface unit IF-2 for interfacing with the secondary communication apparatus 11. The processing unit PU, 10 and the components of the secondary processing and control system S-ELAB-CONTR-2 are suitably connected by connection means 200 such as conventional data buses.

[0034] The system S-ELAB-CONTR-2 also advantageously has a secondary vehicle database DB-2 in which data relating to the identification of each taxi 5 and preferably data indicative or the presence or absence of each taxi 5 in the corresponding taxi rank 6, are stored.

[0035] The secondary database DB-2 may be associated with the memory 101, which is advantageously of the non-volatile type, or the secondary database DB-2 may be stored in storage means separate therefrom.

[0036] The secondary processing and control system S-ELAB-CONTR-2 also has a secondary software module SW-2 for controlling the operation of the local device 3.

[0037] The secondary communication apparatus 11 includes suitable transmission means (not shown) for

transmitting to the main system 2 signals carrying data identifying the taxis 5 present in the corresponding taxi rank 6 and data identifying the taxi rank itself. Moreover, in addition to the datum identifying the taxi rank 6, the secondary communication apparatus 11 can transmit signals which also carry data correlated with an "entry/exit" event relating to a taxi 5 and the respective identification datum.

[0038] The secondary communication apparatus 11 is preferably an apparatus suitable for operating within a cellular telephony system such as, for example, a GSM system, and may be formed by existing commercially available devices. In one particular embodiment of the invention, the secondary communication apparatus 11 comprises a cellular telephone apparatus, that is, a cellular telephone which can be connected to the secondary processing and control system S-ELAB-CONTR-2 in conventional manner. For example, the cellular telephone can be connected to a serial port of a programmable operation and control unit, preferably a microcomputer used as the secondary processing and control system S-ELAB-CONTR-2.

[0039] Moreover, according to alternative embodiments, the secondary communication apparatus 11 may comprise apparatus for communication with the main system 2, operating by means of radio links or by other connection means such as, for example, telephone lines, optical fibres, or any suitable transmission channel.

[0040] The energy for supplying the above-mentioned components of the local device 3 may be provided by a supply system 12 suitably protected from voltage drops in the primary mains supply, or by an independent device such as, for example, a generator with photovoltaic panels.

[0041] The above-described components of the secondary node 3 are disposed in a housing 13 suitable for protecting them from external conditions or phenomena which might affect their operation such as, for example, temperature variations, moisture, or magnetic fields.

[0042] Moreover, the local device 3 may advantageously be protected from interventions by unauthorized people (for example, the housing 13 may be locked with a key or disposed in a place which is not accessible to unauthorized people).

[0043] An embodiment of the main system 2 is shown in Figure 3 by means of functional blocks which may represent hardware and/or software components.

[0044] The main system 2 constitutes the heart of the system 1, can perform various functions, and may be disposed in a housing separate from the local devices 3, or may be disposed in the same housing as one of the local devices.

[0045] The main system 2 can receive the signals transmitted by each local device 3 and makes available at an output of its own signals carrying a datum relating to the "state of occupation of the taxi rank" for the taxi ranks 6, a datum identifying each taxi 5, and a datum relating to the service priority of each the taxis 5 which are standing in the respective taxi rank.

[0046] The main system 2 can also update a suitable database with which it is provided, on the basis of the data carried by the signals transmitted by the local devices 3.

[0047] In particular, the main system 2 is such as to receive the requests made by users (for example, by means of telephone calls) and to find the available taxi which is most suitable for the user's requirements.

[0048] According to a preferred embodiment of the invention, the main system 2 comprises apparatus which performs the role of a telephone switchboard, enabling a telephone call made by a user and received by the main system 2 to be transferred to communication apparatus associated with a suitably selected taxi 5.

[0049] According to one particular embodiment of the invention, the main system 2 comprises a main processing and control system S-ELAB-CONTR-1, an updating RC-TR communication apparatus 14 for communicating with the respective local devices 3, and a transfer and communication apparatus COMM-SWT 15 for controlling communications with one or more users and/or with one or more taxis 5. The main processing and control system S-ELAB-CONTR-1 is connected to the updating communication apparatus 14 and to the communication and transfer apparatus 15 by suitable connection means 204 including, for example, conventional data buses.

[0050] The main processing and control system S-ELAB-CONTR-1 is suitable for receiving the signals carrying the data identifying the taxis 5 and the information relating to the state of occupation of the taxi ranks 6 and for processing and storing this data.

[0051] The processing and control system S-ELAB-CONTR-1 is also such as to associate with each taxi 5 a priority datum, that is, a datum which enables a group of taxis to be arranged in order in a queue, so as to be able to establish the order of precedence in which these taxis may perform the service.

[0052] The main processing and control system S-ELAB-CONTR-1 can also generate signals for controlling or driving the third communication apparatus 14 and the communication and transfer apparatus 15 in the manner which will be described in greater detail in the following description.

[0053] The main processing and control system S-ELAB-CONTR-1 may be formed by suitable processing means constituted, for example, by a conventional electronic processor (a computer).

[0054] According to one embodiment of the invention, this main processing and control system S-ELAB-CONTR-1 comprises a main processing unit PU, 16, a working memory 17 (for example, a RAM), and a read-only memory (a ROM) 18.

[0055] The main processing and control system S-ELAB-CONTR-1 further comprises a main, management software module SW-MNG-1 for managing the main system 2 in accordance with the invention. For ex-

ample, this main, management software module is a computer program which can be loaded into a memory (for example, a mass memory) of the main processing and control system.

[0056] Moreover, the main system S-ELAB-CONTR-1 includes a main database DB-1 and a road-traffic database DB-ROAD-COND.

[0057] The main database DB-1 is such as to hold registration data or information relating to each taxi 5 (for example, the number of a mobile telephone with which each taxi 5 is provided), topological information relating to the arrangement of the local devices 3 within the territory, and information relating to the state of occupation of each taxi rank 6 and the priority associated with each taxi 5 waiting in a respective taxi rank 6.

[0058] The road-traffic database DB-ROAD-COND contains a map of road conditions which associates a defined position with each address of a user of the taxi service, for example, by means of a pair of coordinates or, for example, by means of a data string corresponding to the name of a street. The main processing unit 16 can determine the most convenient taxi rank 6 for that user and/or a plurality of taxi ranks 6 arranged in order of their convenience for the user, on the basis of the map of road conditions.

[0059] The most convenient taxi rank 6 may advantageously be selected not only on the basis of the spatial distance, that is, the taxi rank nearest to the area indicated by the user, but also on the basis of travelling time and/or costs. The road-traffic database DB-ROAD-COND can preferably be modified on the basis of signals received from the exterior and/or by direct programming, so as to update changes in road conditions. For example, the map of road conditions can be modified over time, in parallel with changes in road traffic conditions.

[0060] The main database DB-1 and the road-traffic database DB-ROAD-COND may be associated with storage means separate from the working memory 17 (as shown in Figure 3), or may be associated with the working memory.

[0061] Moreover, the main processing and control system S-ELAB-CONTR-1 includes an optional software module SW-VOC-M for the management of synthesized voice signals (a voice menu), stored on a suitable substrate (for example, a non-volatile mass memory such as a magnetic/optical substrate). The software module SW-VOC-M enables a dialogue with the user who has contacted the taxi service to be managed by means of these voice signals. The dialogue is directed towards the acquisition, in the main processing and control system S-ELAB-CONTR-1, of information/data relating to the address of the location at which the user requires the taxi 5.

[0062] The voice dialogue is advantageously such as to require a minimal number of question-reply cycles so as to have a limited duration.

[0063] The main processing and control system S-ELAB-CONTR-1 preferably has a software module SW-FIN-DEST-M which enables the most convenient taxi rank 6 for the taxi's next stop to be determined on the basis of the position of the location in which the taxi 5 is situated upon completion of the service (the destination location). This module SW-FIN-DEST-M is, for example, operatively associated with the road-traffic database DB-ROAD-COND.

[0064] Moreover, suitable units, represented schematically by the blocks IF-3 and IF-4 in Figure 3, are provided for interfacing of the main processing and control system S-ELAB-CONTR-1 with the updating communication apparatus 14 and with the communication and transfer apparatus 15, respectively.

[0065] The updating communication apparatus 14 is such as to receive the signals which are transmitted by the secondary communication apparatus 11 included in each local device 3 and which carry data relating to the taxis 5 present in a respective taxi rank 6. Moreover, the updating communication apparatus 14 makes available on the bus 204, which is suitably connected to the main processing and control system S-ELAB-CONTR-1, detected signals carrying the data transmitted by each local device 3 and having, for example, the form of digital electrical signals.

[0066] The communication apparatus 14 is formed in a manner such as to be compatible with the secondary communication apparatus 11 and is therefore similar thereto and does not require further description. For example, it is transceiver apparatus suitable for operating in a cellular telephony system.

[0067] The communication and transfer apparatus 15 enables signals to be received/transmitted from/to a communication apparatus associated with a user 7. These signals carry data necessary for identifying a taxi rank 6 convenient for the user 7.

[0068] In particular, the apparatus 15 enables telephonic communications (on a fixed or mobile telephone network) or other telematics communications (for example, by means of the Internet) to be performed by a user who requires the taxi service. In particular, the apparatus 15 enables a telephone conversation to be held with the user in order to acquire data relating to the service required.

[0069] This telephone conversation may take place between the user and an operator of the main system 2 or, preferably, may take place between the user and the synthesized voice managed by the above-mentioned software module SW-VOC-M, or by means of guide voice menus for interaction with the telephone keypad.

[0070] The communication and transfer apparatus 15 also has suitable transfer means which enable the communication taking place with the communication apparatus associated with the user (7) to be interrupted in order to establish a communication with a communication apparatus associated with the taxi 5.

[0071] In particular, the communication and transfer apparatus 15 enables the call made by the user 7 to the

main system 2 to be transferred to an apparatus which is also telephonic and with which a suitably selected taxi 5 is provided. The communication and transfer apparatus 15 thus enables direct telephonic communication also to be established between a driver of the taxi 5 and the user 7.

[0072] This call transfer may be performed by an operator (a switchboard operator) or, preferably, may be performed automatically by means of control or driving signals sent to the communication and transfer apparatus 15 by the main processing and control system S-ELAB-CONTR-1.

[0073] If the call transfer can be performed by an operator, the main processing and control system S-ELAB-CONTR-1 has consultation means 205 (such as, for example, a monitor and a keyboard) which enable the operator to consult the road-traffic database DB-ROAD-COND and the main vehicle database DB-1 in order to be aware of the information relating to the most convenient taxi rank and to the identification of the taxi having highest priority, and its telephone number.

[0074] The communication and transfer apparatus 15 may be formed by hardware and/or software components of types which will be clear from this description to a person skilled in telecommunications.

[0075] In particular, the communication and transfer apparatus 15 may comprise a programmable telephone switchboard of known type, marketed, for example by Telecom Italia.

[0076] According to one particular embodiment, the communication and transfer apparatus 15 may comprise one or more telephone answering devices (not shown) provided with suitable apparatus (for example, modems) for interfacing with the specific telephonic telecommunication system (mobile or fixed) used by the user and with the main processing and control system S-ELAB-CONTR-1.

[0077] It is pointed out that, according to a further embodiment of the invention, the user may communicate with the main system 2 in order to request the taxi service by means of a telematics network such as the Internet or the Teletext network. In this case, in order to identify the location at which the user requires the taxi service, as an alternative to a dialogue, the user may fill in, by means of his own personal computer, a suitable form which can be displayed on a monitor.

[0078] It is also pointed out that the above-described main processing and control system S-ELAB-CONTR-1 may include a single computer, as shown in the embodiment of Figure 3, or may include a plurality of computers connected so as to constitute a network. The selection between the use of a single computer and the use of a network of computers is connected with the amount of information to be managed and/or with the number of telephone lines to be switched towards the taxis 5, and/or with the optional capability for connection to an Internet network from which to receive requests for a taxi service. A plurality of computers can ensure greater reliability of the system.

[0079] The apparatus described with reference to the main system 2 is advantageously arranged in a housing (not shown in Figure 2) of similar type to the housing 13 for the local device 3. Moreover, as stated for the local device 3, the electrical energy for the supply of the apparatus of the main system 2 is supplied by a suitable supply system appropriately protected against voltage drops in the primary supply.

[0080] With reference to the taxis 5 managed by the telematics system 1, Figure 4 shows schematically an on-board station or node 100 to be used on board each taxi 5.

[0081] The on-board node 100 is such as to transmit and receive suitable signals to/from the main system 2 and/or to/from the local devices 3 and to permit communication between the driver of the taxi 5 and the users 7.

[0082] The on-board node 100 comprises an RC-TR vehicle-local communication apparatus 19, an on-board communication apparatus 20, and an on-board processing and control system S-ELAB-CONTR-3, which are connected by suitable connection means such as, for example, data buses 206.

[0083] The vehicle-local communication apparatus 19 is for communicating with the local communication apparatus 9 of the local device 3 corresponding to the taxi rank 6 in which the taxi 5 is disposed. In particular, the vehicle-local communication apparatus 19 comprises receiving means for receiving interrogation signals emitted by the local communication apparatus 9 and transmission means for transmitting signals identifying the taxi 5 on which it is installed.

[0084] The vehicle-local communication apparatus 19 disposed on the taxi 5 is of a type compatible with the local communication apparatus 9 included in each local device 3 and is therefore similar thereto. In particular, the apparatus 19 may be a conventional short-range apparatus such as, for example, a radio-frequency device or an emitter/transmitter of infra-red light signals.

[0085] The on-board communication apparatus 20 is such as to permit communications with the main system 2 and with a user 7 of the taxi service. In particular, the communication apparatus is such as to operate within a cellular telephony system such as, for example, a conventional mobile telephone which can be associated with the vehicle 5, possibly removably.

[0086] According to a preferred embodiment of the invention, the on-board processing and control system S-ELAB-CONTR-3 is a programmable electronic processor for managing the apparatus disposed on board the respective taxi 5.

[0087] The on-board processing and control system S-ELAB-CONTR-3 may be of known type and may comprise conventional integrated-circuit electronic devices (for example, a microprocessor and semiconductor memories). Moreover, a software module MNG-SW-ABD for managing the on-board apparatus is

associated with the on-board processing and control system S-ELAB-CONTR-3.

[0088] The on-board node 100 optionally also comprises interface means such as to enable a driver of the taxi 5 to interrogate the main vehicle database DB-1 of the main system 2 in order to be aware of the state of occupation of the taxi ranks 6 and, preferably all of the information which is useful for performing the service. For example, these means comprise a suitable screen or monitor 22 and a keyboard 23.

[0089] The above-described apparatus and devices may advantageously be incorporated in the dashboard of a taxi 5.

[0090] It is also pointed out that, as will be clear to a person skilled in the art, the processing and control systems described with reference to the local devices 3, to the main system 2, and to the taxis 5, are timed by suitable timing devices (clocks) CLK.

[0091] The method of managing the taxis 5 in accordance with the invention comprises a step for the updating of the main vehicle database DB-1 of the main system 2. For example, this updating step is activated as a result of an entry event relating to a taxi 5.

[0092] A particular example of the operation of the system 1 in implementing the updating step will now be described.

[0093] In this connection, it is assumed that a taxi 5 enters a taxi rank 6 in order to park whilst waiting to be called by a user 7.

[0094] When the taxi 5 is in (or in the vicinity of) a specific taxi rank 6, the vehicle-local communication apparatus 19 (disposed on board the taxi 5) receives an interrogation signal emitted by the local communication apparatus 9 of the local device 3. In response to this interrogation signal, the vehicle-local communication apparatus 19 transmits an identification signal carrying, for example, a code (or number) identifying the taxi 5.

[0095] The local communication apparatus 9 of the local device 3 receives the identification signal and makes the signal received available to the secondary processing and control system S-ELAB-CONTR-2.

[0096] According to one embodiment of the invention, the secondary processing and control system S-ELAB-CONTR-2 stores, in the secondary vehicle database DB-2 of the local device 3, a presence/absence datum (for example, one bit) representative of the presence or of the absence of that specific taxi 5 in the respective reference location.

[0097] The secondary processing and control system S-ELAB-CONTR-2 of the local device 3, which is managed by the secondary software SW-2, drives the secondary communication apparatus 11 which transmits an output signal to the main system 2. The output signal carries data/information relating to the identification of the taxi 5 which has entered the taxi rank and to the identification of the specific taxi rank 6.

[0098] If the secondary communication apparatus 11 is suitable for operating within a cellular telephony system, the output signal is advantageously a SMS (short message service) message.

[0099] The updating communication apparatus 14 of the main system 2 receives the signal transmitted by the local device 3 and makes it available to the main processing and control system S-ELAB-CONTR-1 in a suitable form.

[0100] The main processing unit 16 of the main processing and control system S-ELAB-CONTR-1 assigns a priority to the taxi 5, taking into account the priorities of the other taxis present in the taxi rank 6 and on the basis of the signal received from the local device 3, and stores this information in the main vehicle database DB-1.

[0101] Figure 5 shows schematically an embodiment of the structure of the main vehicle database DB-1.

[0102] According to the embodiment of Figure 5, the main vehicle database DB-1 is organized, from a logic point of view, as a plurality of N lists L1-LN, each relating to a reference location or taxi rank 6.

[0103] Each list L1-LN contains codes TAX1-TAXM identifying each taxi present in a respective taxi rank. Each list L1-LN represents the state of occupation of a respective taxi rank. For example, an empty list would indicate that there were no taxis available in that taxi rank.

[0104] Moreover, in each list L1-LN, the taxi identification codes are arranged in order, on the basis of the priority acquired (P1-Pi). For example, the taxi having the identification code TAX3 of the list L1 has higher priority than that having identification code TAX5.

[0105] The step of assigning a priority to each taxi 5 which stops in a respective taxi rank 6 is performed, for example, by the main processing and control system S-ELAB-CONTR-1, on the basis of the chronological order in which the signals emitted by the local device 3 as a result of each entry event are received.

[0106] The method of managing the taxis 5 according to the invention also comprises a step for checking the occupation states of the taxi ranks 6.

[0107] The step for checking the occupation states can be activated at predetermined intervals and enables the main vehicle database DB-1 of the main system 2 to be updated. In particular, this checking step enables the order of the priorities assigned in the main vehicle database DB-1 to be updated.

[0108] For example, the step for checking the occupation states comprises a step for updating the secondary vehicle database DB-2.

[0109] In this step, the local communication apparatus 9 of the local device 3 transmits a taxi-interrogation signal. In particular, the transmission of the interrogation signal is repeated at a predetermined frequency f1, that is, it is repeated at predetermined time intervals.

[0110] According to one particular embodiment, if the local communication apparatus 9 does not receive an identification signal of a specific taxi in response, the secondary processing and control system S-ELAB-CON-

TR-2 stores in the secondary vehicle database DB-2 a datum representative of the absence of that specific taxi. This datum can be transmitted to the main vehicle database DB-1.

[0111] According to a preferred embodiment of the invention, it is possible to arrange for a datum representative of the absence of a specific taxi 5 to be stored in the secondary vehicle database DB-2 only after that taxi 5 has not responded to the interrogation signal on a number of occasions S greater than 1.

[0112] In this case, for example, upon each missed response to the interrogation signal transmitted by the local communication apparatus 9, a number F output to a digital counter (not shown) included in the secondary processing and control system S-ELAB-CONTR-2 is increased by one unit. When the number F exceeds a maximum value correlated with a period of time considered to be indicative of the absence of the taxi 5, the secondary processing and control system S-ELAB-CONTR-2 considers the specific taxi 5 to be absent and consequently updates the secondary database DB-2.

[0113] This preferred embodiment confers greater reliability on the system 1 since it prevents a taxi 5 being considered absent/present after a single interrogation.

[0114] In fact, if this method is used, a taxi 5 which has not responded to the interrogation signal owing to a temporary technical impediment is not considered absent or, for example, a taxi 5 which is in the vicinity of the taxi rank 6 by chance (and enters the range of operation of the apparatus 9) is not considered present.

[0115] The step for checking the occupation state also comprises a step in which a signal for interrogating the local devices 3 is transmitted by the secondary communication apparatus 11. In particular, the transmission of the signal for interrogating the local devices 3 may be repeated at a frequency f2, for example, less than the frequency f1.

[0116] After the local device 3 has received this signal for interrogating the external nodes, the secondary processing and control system S-ELAB-CONTR-2 consults the secondary vehicle database DB-2 in which the presence or the absence of each taxi 5 is indicated.

[0117] The local device 3 then transmits signals containing the information on the state of occupation of the taxi ranks 6 (the codes and priorities of the taxis present).

[0118] The updating communication apparatus 14 receives these signals transmitted by the local device 3 and makes them available to the main processing and control system S-ELAB-CONTR-1 which consequently updates the main vehicle database DB-1. In particular, the priorities assigned to the taxis 5 are modified.

[0119] The state of occupation of a taxi rank 6 can be modified if a taxi 5 enters or if a taxi 5 leaves the taxi rank 6, for example, owing to the arrival of a user 7, or upon receipt of a telephone call.

[0120] The ways in which the method according to the invention operates with regard to a user 7 who makes a request for a taxi will now be described.

[0121] It is pointed out that the system 1 can advantageously provide for a single telephone number usable by all of the users, irrespective of the fact that several taxi ranks may be provided and a single company or several separate companies may make use of the management offered by the system 1.

[0122] The single telephone number enables telephonic communication to be established between the user and the communication and transfer apparatus 15 which is interfaced with several telephone lines.

[0123] A situation in which a user 7 makes a telephone call which puts him into communication with the communication and transfer apparatus 15 of the main system 2 will be considered.

[0124] The receipt, by the apparatus 15, of the telephone call made by the user 7 activates, for example, the transmission to the user of pre-recorded voice signals (sound) controlled by the software module SW-VOC-M.

[0125] In addition to optional voice signals introducing the service, voice signals which include questions directed towards determining a specific area 8 of the territory 4 within which the user 7 desires the presence of a taxi are transmitted to the user 7.

[0126] On the basis of the replies received, the main processing and control system S-ELAB-CONTR-1 of the main system 2 identifies the most convenient taxi rank 6 for the user 7.

[0127] In greater detail, during the step of the identification of the most convenient reference location 6, the main processing and control system S-ELAB-CONTR-1 consults the road-traffic database DB-ROAD-COND in order to determine, for example, the coordinates of the point in the territory 4 corresponding to the address supplied by the user 7.

[0128] In a subsequent step, the main system S-ELAB-CONTR-1 performs a process (such as, for example, a trigonometrical calculation) on the basis of the data stored in the road-traffic database DB-ROAD-COND and on the coordinates identified above. As a result of this process, the main system S-ELAB-CONTR-1 determines the nearest taxi rank 6.

[0129] During this step for the identification of the most convenient taxi rank 6, it is possible to take into consideration not only topological data but also data (which can preferably be stored in the database DB-ROAD-COND in real time) relating to road traffic. The most convenient location identified may not therefore correspond to the location nearest to the place indicated by the user 7 but may be the most convenient in terms of time.

[0130] In a subsequent step, the main system S-ELAB-CONTR-1 performs a process to identify the available taxi 5 which has the highest priority. An example of this step will be described in greater detail below with reference to Figure 6.

[0131] Nevertheless, it is pointed out that the man-

agement of the waiting and of the priorities of the taxis 5 in a taxi rank 6 is preferably performed in accordance with a FIFO logic (first in, first out). In other words, with reference to the list L2 of the main vehicle database DB-1 shown in Figure 4, the taxi with the identification code TAX100 which reaches the taxi rank at a moment t1 will be put into communication with the user 7 before a taxi with an identification code TAX1 which reached the same taxi rank at a moment t2 subsequent to t1.

[0132] After the step of the identification of the taxi 5 with the highest priority (that is, for example, the taxi which arrived at the taxi rank first), the main processing and control system S-ELAB-CONTR-1 transmits driving signals to the communication and transfer apparatus 15 in order to transfer the call of the user 7 to the communication apparatus 20 on board the taxi 5 identified.

[0133] As a result of this transfer, a direct conversation can take place between the user 7 and the taxi driver 5.

[0134] It is pointed out that the preferred embodiment of the invention described above enables the communication with the user, the determination of the most convenient taxi rank 6, the determination of the taxi 5 with the highest priority, and the transfer of the call to be performed completely automatically.

[0135] This embodiment is particularly advantageous since it reduces the costs of the telephone call and the waiting times for the user.

[0136] However, according to an alternative embodiment of the invention, the presence of an operator may be provided for in the main system. In this case, the operator can talk with the user 7 to find out the address at which the taxi service is required. On the basis of the information received, the operator can then consult the main processing and control system S-ELAB-CONTR-1 with the use of the consultation means 205, in order to find out the most convenient reference location 6 and the taxi 5 with the highest priority. The operator can also transfer the call of the user 7 to the driver of the taxi 5 selected.

[0137] It should be noted that, by virtue of the fact that the operator can make use of the information stored in the main vehicle database DB-1 and in the road-traffic database DB-ROAD-COND, the identification of the taxi rank 6 and the selection of the taxi 5 which are most convenient for the user are particularly precise.

[0138] As already emphasized, a method of requesting a taxi 5 according to which the user 7 can make a suitable form available to the main system 2 with the use of the Internet and thus without making telephonic communication is also provided for.

[0139] According to a further embodiment of the invention, the main processing and control system S-ELAB-CONTR-1 has a software module COD-ALF-NUM suitable for recognizing an alphanumeric code which can be keyed in by the user 7 when telephoning the taxi service. For example, this alphanumeric code may be keyed in consecutively with the telephone number.

[0140] As a result of the recognition of the alphanumeric code, the main processing and control system S-ELAB-CONTR-1 can provide for the activation of particular procedures such as:

- immediate location of the user's position, if the alphanumeric code corresponds to a predefined location (airports, railway stations, exhibitions and the like);
- selection, during the procedure for finding the nearest taxi, of a vehicle equipped for the transportation of invalids in wheelchairs or other particular services (vehicles for transporting goods);
- transfer of the call directly to the taxi selected;
- activation of service and support functions for the maintenance of the apparatus.

[0141] It is pointed out that the use of alphanumeric codes is particularly advantageous since it permits the implementation of functions which can be adapted to needs that may emerge in the future, without significantly complicating the apparatus of the system 1.

[0142] The steps for the identification of the taxi rank 6 and for the selection of the taxi 5 will now be described in greater detail than was given above. In the following description, reference will be made to a particular embodiment of the method of the invention illustrated schematically in Figure 6.

[0143] After an initial step SRT, the method continues with the step NERST-PRK-DET-1 for the identification of the most convenient taxi rank (for example, the nearest), an example of which has already been described. With reference to Figure 4, it is assumed that the nearest taxi rank is the taxi rank L2.

[0144] The method continues with a first checking step CHCK-TAXI-AV-1 in which the availability of at least one taxi in the taxi rank L2 is checked. During this step CHCK-TAXI-AV-1, the processing and control system reads the contents of the main vehicle database DB-1 and checks whether at least one taxi-identification code is entered in the list L2 of the table of Figure 4, or whether it is empty.

[0145] If it is found that an available taxi, for example the taxi with the code TAX100, is present, the method continues along the branch Y1, if not, it continues along the branch N1.

[0146] After the CHCK-TAXI-AV-1 step, the branch Y1 leads to the call transfer step CAL-TRANSF.

[0147] In greater detail, in the CAL-TRANSF step, the main processing and control system S-ELAB-CONTR-1 drives the communication and transfer apparatus 15 in a manner such that it transfers the user's telephone call to the on-board communication apparatus 20 which is associated with the taxi 5 having the code TAX100 and which is constituted, in this example, by a mobile telephone. It is pointed out that the telephone number of the telephone 20 can be stored in the main vehicle

database DB-1. As a result of the transfer of the call, the taxi driver can answer and speak directly to the user 7.

[0148] According to another particularly advantageous embodiment of the invention, additional steps are provided for, in which, after the communication and transfer apparatus 15 and the main processing and control system S-ELAB-CONTR-1 have detected that the on-board communication apparatus 20 associated with the taxi 5 is not starting communication, they establish a different communication with another communication apparatus associated with another taxi 5.

[0149] In particular, if the telephone 20 of the driver of the taxi 5 with highest priority is engaged or if the taxi driver does not answer the telephone, the call is transferred to another taxi.

[0150] According to this embodiment of the invention, after the transfer step CAL-TRANSF, the method according to the invention provides for a step CONTR-LNE in which it is checked whether the mobile telephone 20 of the taxi with the code TAX100 is engaged or free. If the mobile telephone 20 is engaged, the method continues along the branch Y2, otherwise it continues along the branch N2.

[0151] Moreover, continuing along the branch N2, the method shown schematically in Figure 6 comprises a preferred step CAL-RNG-COUNT in which the number of rings of the telephone 20 of the taxi called is counted. If the taxi driver answers (branch Y3 and step RESP) within a predetermined number of rings "R" (corresponding to a predetermined waiting time for the user), the method terminates in a final step ED.

[0152] If, on the other hand, the taxi driver does not answer within the predetermined number of rings R, the method continues along the branch N3.

[0153] It should be noted that a conventional programmable switchboard used to form the communication and transfer apparatus 15 enables the engaged signal to be identified and the rings to be counted in the event of a failure to reply.

[0154] If the driver's telephone 20 is engaged (branch Y2) or the driver does not answer the call (branch N3), the method of the invention provides for a second checking step CHCK-TAXI-AV-2. In this second step CHCK-TAXI-AV-2, which is similar to the checking step CHK-TAXI-AV-1, the availability of another taxi in the same taxi rank is checked. For example, in the list L2 of Figure 4, the taxi with highest priority, but with lower priority than the taxi with the code TAX100, is that with the code TAX1.

[0155] Once this taxi with the code TAX1 has been identified, the method returns (branch Y4) to the call transfer step CAL-TRANSF.

[0156] If it is found by the checking step CHKC-TAXI-AV-2 that there are no taxis available in the taxi rank L2 (branch N4) a checking step PRK-DIST-EVAL is provided for assessing, for example, by automatic consultation of the road-traffic database DB-ROAD-COND, whether there are other taxi ranks 6 near enough to the location indicated by the user 7.

[0157] If there are other sufficiently convenient taxi ranks (branch Y5), the method of the invention provides for a further identification step NRST-PRK-DET-2 in which another taxi rank convenient to or in the vicinity of the location indicated by the user 7 is identified.

[0158] After the step NRST-PRK-DET-2, the method returns (branch ITER-1) to the step CHCK-TAXI-AV-1 to check the availability of a taxi.

[0159] If the step PRK-DIST-EVAL shows that there are no taxi ranks near enough (branch N5), the method according to the invention may advantageously provide for a step TRANSF-RDTAXI for the transfer of the call made by the user 7 to another taxi-management system, and then terminates in the final step ED. The other system may be similar to the system 1 described or may be any other conventional system such as, for example, a radio taxi call centre of known type.

[0160] This transfer is performed by the communication and transfer apparatus 15 of the main system 2 in a manner similar to the transfer to the mobile telephone of a taxi.

[0161] It should be noted that the method described above can be managed by the main management software module SW-MG-1.

[0162] The system for managing a plurality of vehicles, in particular taxis, according to the invention has many advantages.

[0163] It should be noted that the system enables the distribution of the free and available taxis 5 within the territory to be managed automatically in a manner transparent to the taxi drivers and to any operator.

[0164] The system according to the invention may be such as to permit the use of a single telephone number independently by the cooperative of vehicles or by a single vehicle forming part of the management system.

[0165] Moreover, the facility offered by the invention for direct conversation between the driver and the user enables greater accuracy to be achieved with regard to the location at which the user desires the presence of the taxi.

[0166] It should also be noted that the automatic call-transfer facility permits a drastic reduction in response times and consequently in telephone costs for the user.

[0167] The implementation of the invention which provides for the system to be fully automatic, and which does not therefore require any intervention by an operator, offers good reliability and enables management costs to be reduced.

[0168] The fact that the communications which are established when the system is in operation can also take place by means of mobile telephony systems constitutes an innovation which is particularly advantageous to the user and to the taxi drivers.

[0169] It is pointed out that the system according to the invention may be used in conjunction with technology which allows the taxis to be located not only within the taxi rank but also outside it.

[0170] For example, the on-board node 100 may include devices which operate within satellite navigation systems (GPS, Global Positioning System) which provide the precise position of the taxi. This position can thus be transmitted directly from the taxi 5 to the main system 2, for example, by a packet transmission by a cellular telephony system. This solution avoids the use of local telecommunication devices 3 disposed in the taxi ranks and short-range communication apparatus.

[0171] The user's position may also be identified with the use of techniques proposed by mobile telephony companies which enable the position of a cellular telephone from which the call originates to be located. In this case, voice dialogue with the user is no longer necessary.

[0172] The development of cellular technology involves developments which can be utilized fully by the architecture of the telematics system according to the invention in order to bring about communications between the taxi and the main system 2 and between the taxi and the user. WAP or palmtop systems which enable a large amount of structured data to be made available and thus extend the range of information handled are of particular interest. In this connection, an important support is provided by GPRS technology and by the UMTS communication standard.

[0173] It should also be borne in mind that the telematics system of the invention enables information relating to the state of occupation of the taxi ranks to be made available to external telematics systems such as, for example, local-authority and police traffic-control systems. This information, which is normally resident in the main system 2, may be communicated to these external networks either by means of cellular telephony apparatus (for example, GSM apparatus) similar to those which may be provided on board the taxis, or by normal telephone connections.

[0174] Naturally, in order to satisfy contingent and specific requirements, a person skilled in the art may apply to the telematics system 1 according to the present invention further modifications and variations all of which, however, are included within the scope of protection of the invention as defined by the appended claims.

Claims

1. A system (2) for managing vehicles (5) which are to perform a service within a territory (4) including a plurality of reference locations (6), the system comprising:

- a first device (14) for receiving data signals and for supplying signals received, which carry a datum (TAX1-TAX100) identifying at least one vehicle (5) and a datum relating to the availability of the at least one vehicle in a reference location (6),
- main processing means (S-ELAB-CONTR-1) connected to the first device (14) for processing the signals received and associating a service priority datum (P1-Pi) with the at least one vehicle (5), and for generating an occupation-state datum indicative of the presence of the at least one vehicle (5) in the location (6),
- a first database (DB-1) for storing a code (L1-LN) identifying each of the locations (6) and the state, location and priority (P1-Pi) data, the main processing means being able to cooperate with the first database (DB-1) in order to make available output signals carrying the datum relating to the state of the location (6) and the identification and priority data relating to the at least one vehicle (5) in the location (6).

2. A system (1) according to Claim 1, further comprising a main communication apparatus (15) for transmitting/receiving signals to/from a communication apparatus associated with a user (7) of the service, the signals carrying data for the identification of a reference location (6) which is most convenient for the user (7), in accordance with a predetermined criterion.

3. A system (1) according to Claim 2, further comprising a road-traffic database (DB-ROAD-COND) containing topological information relating to the territory (4) and to the reference location (6), and in which the main processing means (S-ELAB-CONTR-1) are connected to the road-traffic database (DB-ROAD-COND) and to the main communication apparatus (15), the main processing means enabling the reference location which is most convenient for the user (7) to be identified on the basis of the signals sent by the user (7) and on the basis of the road-traffic database.

4. A system (1) according to Claim 1 in which the main processing means enable a respective service priority datum (P1-Pi) to be associated with each vehicle present in a reference location (6) and enable the identification datum of a vehicle (5) having a highest service priority to be made available as an output.

5. A system (1) according to Claim 2 in which the main communication apparatus comprises transfer means (15) for interrupting the communication taking place between the communication apparatus (20) associated with the user (7) and the main communication apparatus (15) and for establishing a communication between the communication apparatus associated with the user (7) and a communication apparatus (20) associated with the vehicle (5).

6. A system according to Claim 5 in which the main processing means generate a driving signal which can be supplied to the transfer means (15) in order to control the transfer of the communication.

7. A system (1) according to Claim 6 in which the main communication apparatus (15) is suitable for operating in a mobile telephony system and the communication apparatus associated with the user (7) and with the vehicle (2) comprise respective mobile telephones.

8. A system according to Claim 5 in which the main communication apparatus comprises a programmable telephone switchboard.

9. A system (1) according to Claim 2 in which the main communication apparatus (15) permits the receipt of telephone calls made by several users (7) to a single telephone number associated with the service.

10. A system (1) according to Claim 2 in which the main communication apparatus (15) enables pre-recorded voice signals to be sent to the communication apparatus associated with the user (7).

11. A system (2) according to Claim 1, further comprising a first transmission device (15) which can be driven by the main processing means (S-ELAB-CONTR-1) in order to transmit interrogation signals relating to the identification of the vehicles (5) and to the state of occupation of the reference locations.

12. A system (2) according to Claim 1 in which the first receiving device (14) is such as to receive the data signals as a result of modifications of the occupation state of the reference location (6) so that the main processing means can update the data stored in the main database (DB-1).

13. A system according to claim 6 in which the main communication apparatus (15) and the processing means (S-ELAB-CONTR-1) can detect when the communication apparatus (20) associated with the vehicle (5) does not start the communication and can establish a different communication with a further communication apparatus associated with a further vehicle (5).

14. A system (2) according to Claim 13 in which the further vehicle (5) is present in the same reference location and has an associated priority datum lower than the priority datum of the vehicle (5).

15. A system (3) according to Claims 3 and 13 in which the further vehicle (5) is in a different reference location which is the next most convenient for the user (7) after the reference location, in accordance with the predetermined criterion.

16. A system according to Claim 13 in which the communication with the further communication apparatus is performed after a predetermined waiting time.

17. A telecommunication device (3) which can be associated with a reference location (6) included in a territory (4) in which a plurality of vehicles (5) offering a service to a plurality of users (7) operate, the device comprising:

- a local communication apparatus (9) for receiving signals indicative of the presence of vehicles (5) in the reference location (6) and for supplying signals carrying data identifying the vehicles (5) at an output (202),
- local processing means (S-ELAB-CONTR-2) connected to the output (202) of the local communication apparatus (9) in order to process the signals detected, the local processing means enabling data signals carrying the data identifying the vehicles present in the reference location (6) and a datum identifying the reference location to be made available at an output.

18. A device (3) according to Claim 17, further comprising a local database (DB-2), operatively associated with the local processing means, for storing the data identifying the vehicles (5) and a datum relating to the presence/absence of each vehicle (5) in the reference location (6).

19. A device according to Claim 17, further comprising a secondary communication apparatus (11) connected to the output of the local processing means (S-ELAB-CONTR-2) for transmitting the data identifying the vehicles (5) present in the reference location (6) and the datum identifying the reference location (6).

20. A device (3) according to Claim 19 in which the local processing means (S-ELAB-CONTR-2) enable signals to be generated for driving the local communication apparatus (9) and the secondary communication apparatus (11).

21. A device (3) according to Claim 19 in which the local processing means (S-ELAB-CONTR-2) can generate interrogation signals regarding the presence of the vehicles (5) in the reference location (6) to be received by a communication apparatus associated with each vehicle (5) present in the reference location (6).

22. A device according to Claims 18 and 21 in which the interrogation signals are emitted at predeter-

mined time intervals in order to receive the signals indicative of the presence of vehicles (5) in response, so as to update the local database (DB-2).

23. A device (3) according to Claim 17 in which the local communication apparatus (9) comprises a short-range telecommunication apparatus.

24. A device (3) according to Claim 17 in which the local communication apparatus (9) comprises a video camera for detecting the presence of the vehicle (5) in the reference location (6).

25. A device according to Claims 17 and 22 in which the local processing means are such as to control the storage, in the local database (DB-2), of a datum relating to the absence of the vehicle (5) from the reference location (6) when the vehicle (5) is found to be absent from the location (6) after a transmission of the interrogation signal, repeated a number of times greater than one.

26. A telematics system (1) for controlling vehicles (5) which are to perform a service within a territory (4) including a plurality of reference locations (6), the system comprising:

- at least one local node provided with a telecommunication device (3) including:
  - a local communication apparatus (9) for receiving signals indicative of the presence of vehicles (5) in the reference location (6) and for supplying, at an output, (202) detected signals carrying data identifying the vehicles (5),
  - local processing means (S-ELAB-CONTR-2) connected to the output (202) of the local communication apparatus (9) for processing the signals detected, the local processing means enabling data signals carrying the data identifying the vehicles present in the reference location (6) and a datum identifying the reference location to be made available at an output,
  - a secondary communication apparatus (11) connected to the output of the local processing means for transmitting data signals carrying data identifying the vehicles (5) present in the reference location (6) and the datum identifying the reference location (6),
  - at least one main node including a system (2) for managing vehicles (5) such as to receive the data signals and to make available at an output a state datum indicative of the presence of at least one vehicle (5) in the location (6), a datum identifying the vehicle (5), and a datum relating to the service priority of the vehicle (5) in the location (6), the system (2) of the main node being formed in accordance with at least one of Claims 1 to 16.

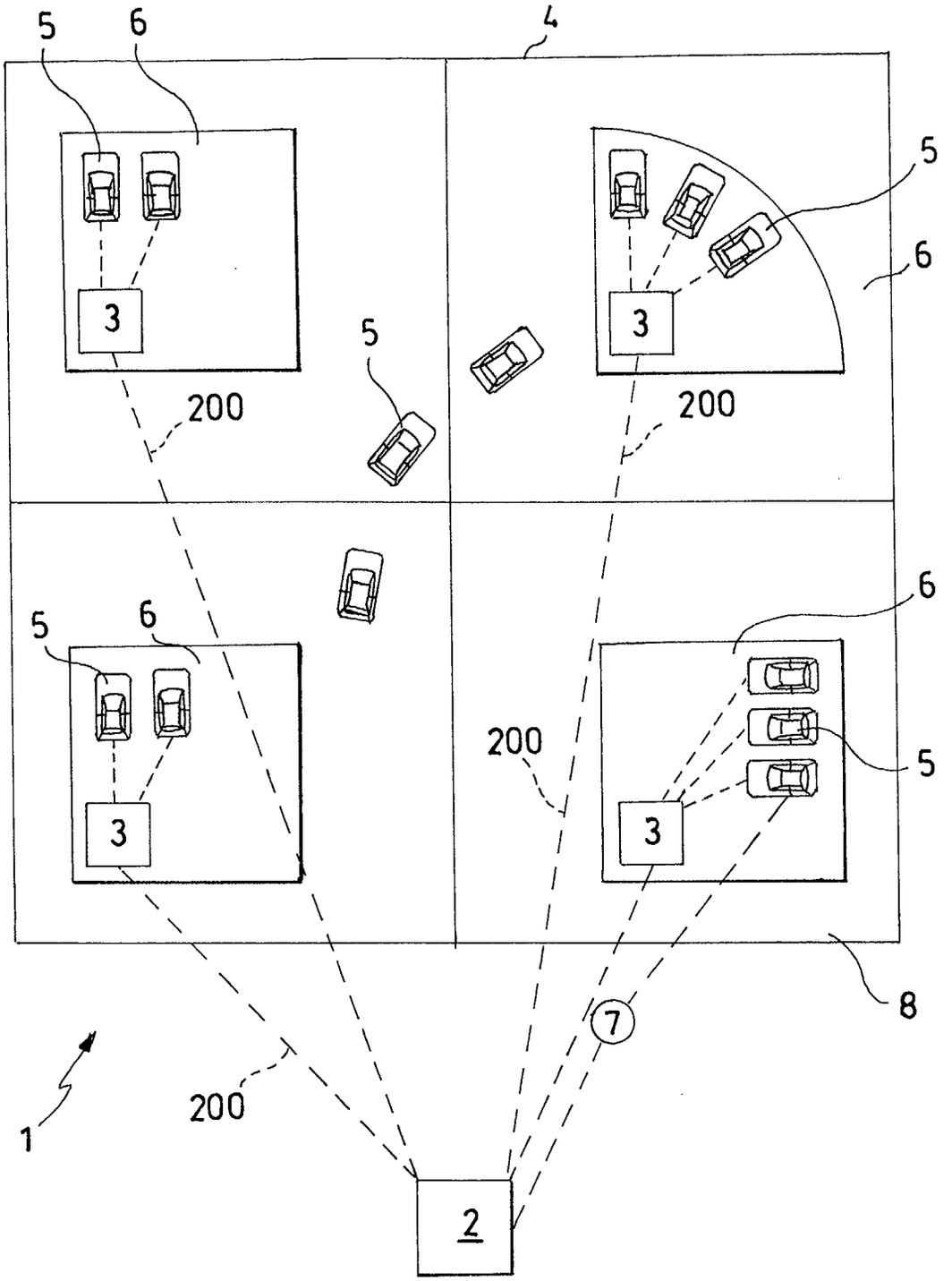

FIG. 1

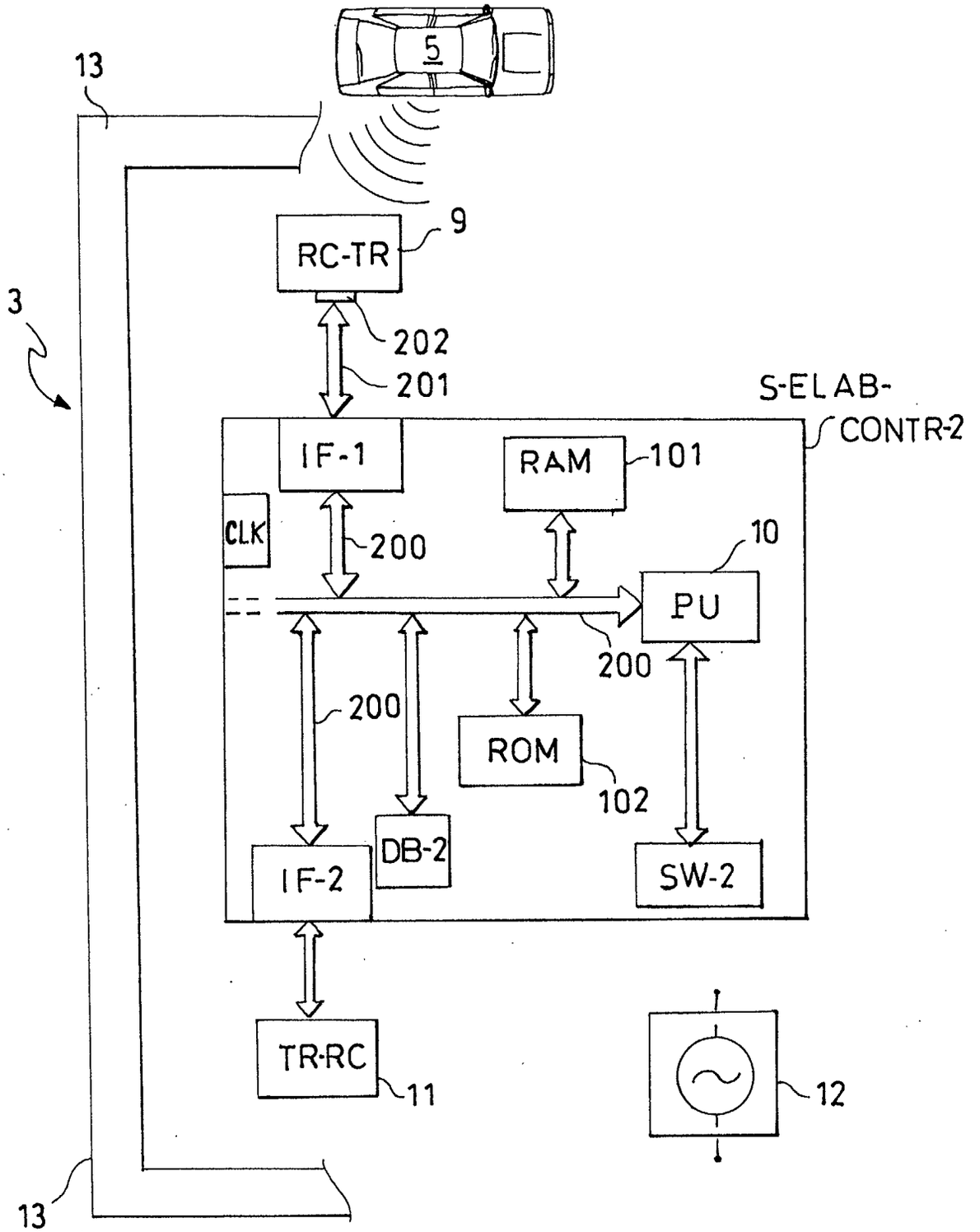
5
13
9
RC-TR
3
202
201
S-ELAB-
CONTR-2
IF-1
RAM
101
CLK
200
10
PU
200
200
ROM
102
DB-2
IF-2
SW-2
TR-RC
11
12
13

FIG.2

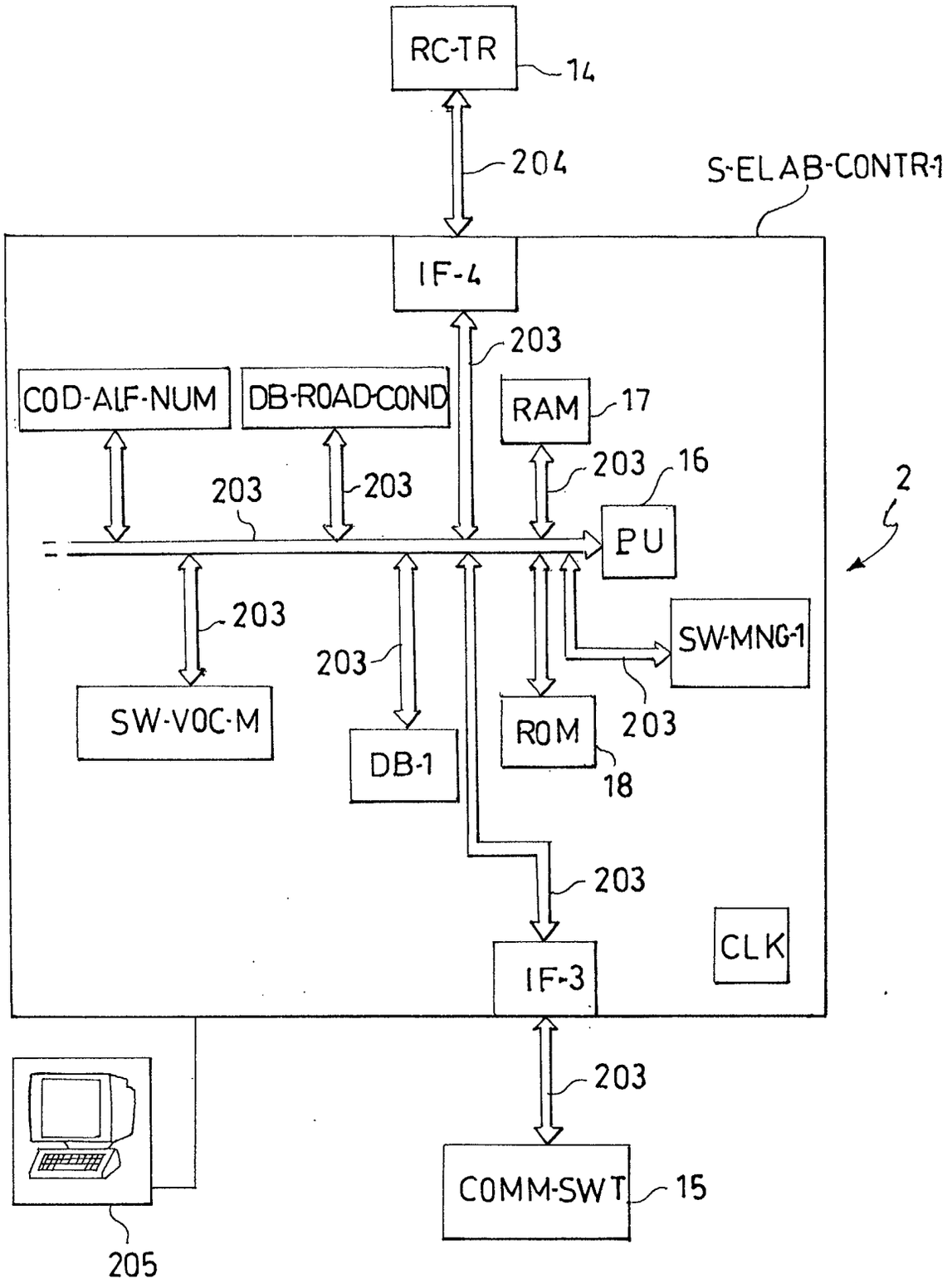
RC-TR
14
204
S-ELAB-CONTR-1
IF-4
203
COD-ALF-NUM
DB-ROAD-COND
RAM
17
203
16
203
203
2
PU
203
SW-MNG-1
203
SW-VOC-M
203
ROM
203
18
DB-1
203
CLK
IF-3
203
COMM-SWT
15
205

FIG. 3

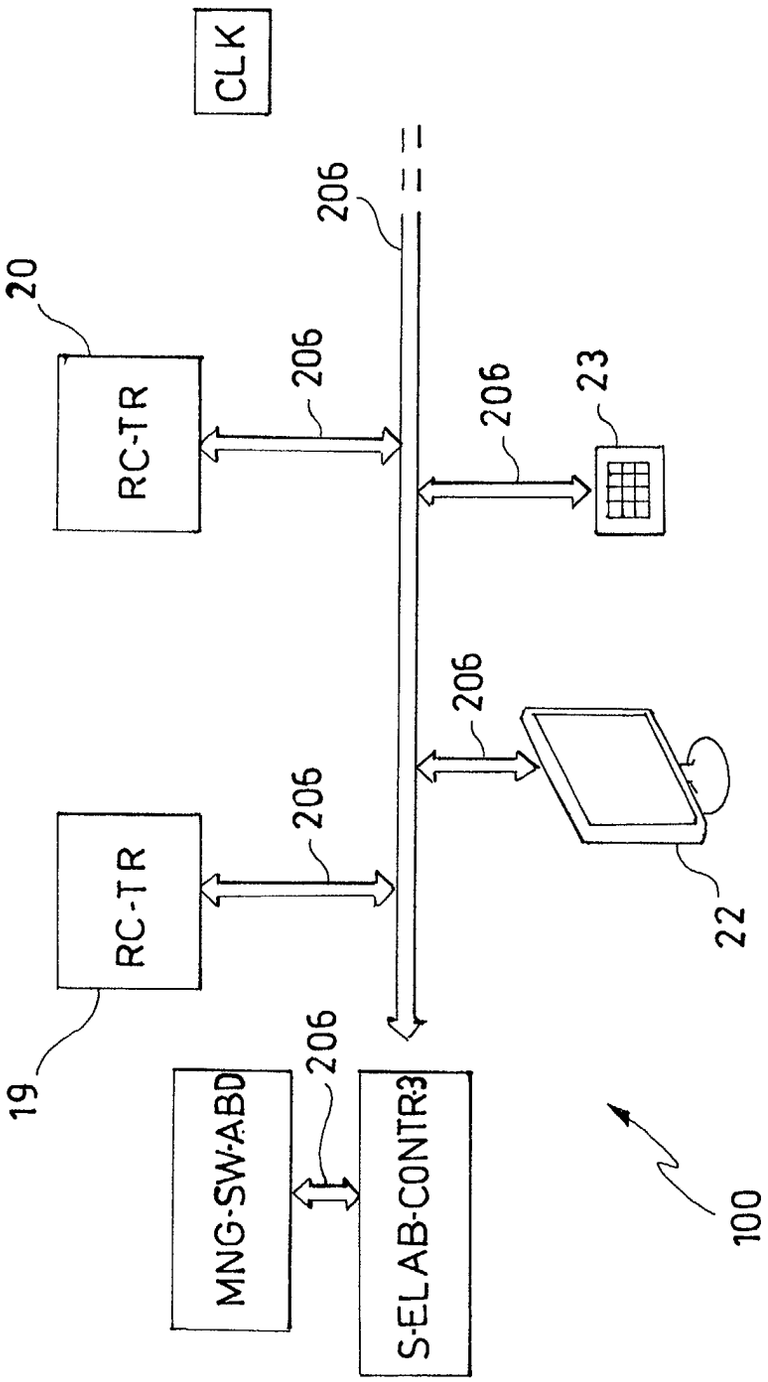
CLK
206
20
RC-TR
206
206
23
206
RC-TR
206
22
19
206
MNG-SW-ABD
S-EL AB-CONTR3
100

FIG. 4

DB-1

	L1	L2	. . .	LN
P1				
P2	TAX 3	TAX100	. . .	TAX6
P3	TAX 5	TAX1	. . .	TAXM
. . .	. . .	. . .	. . .	. . .
Pi	TAX4	TAX7		TAX10

FIG. 5

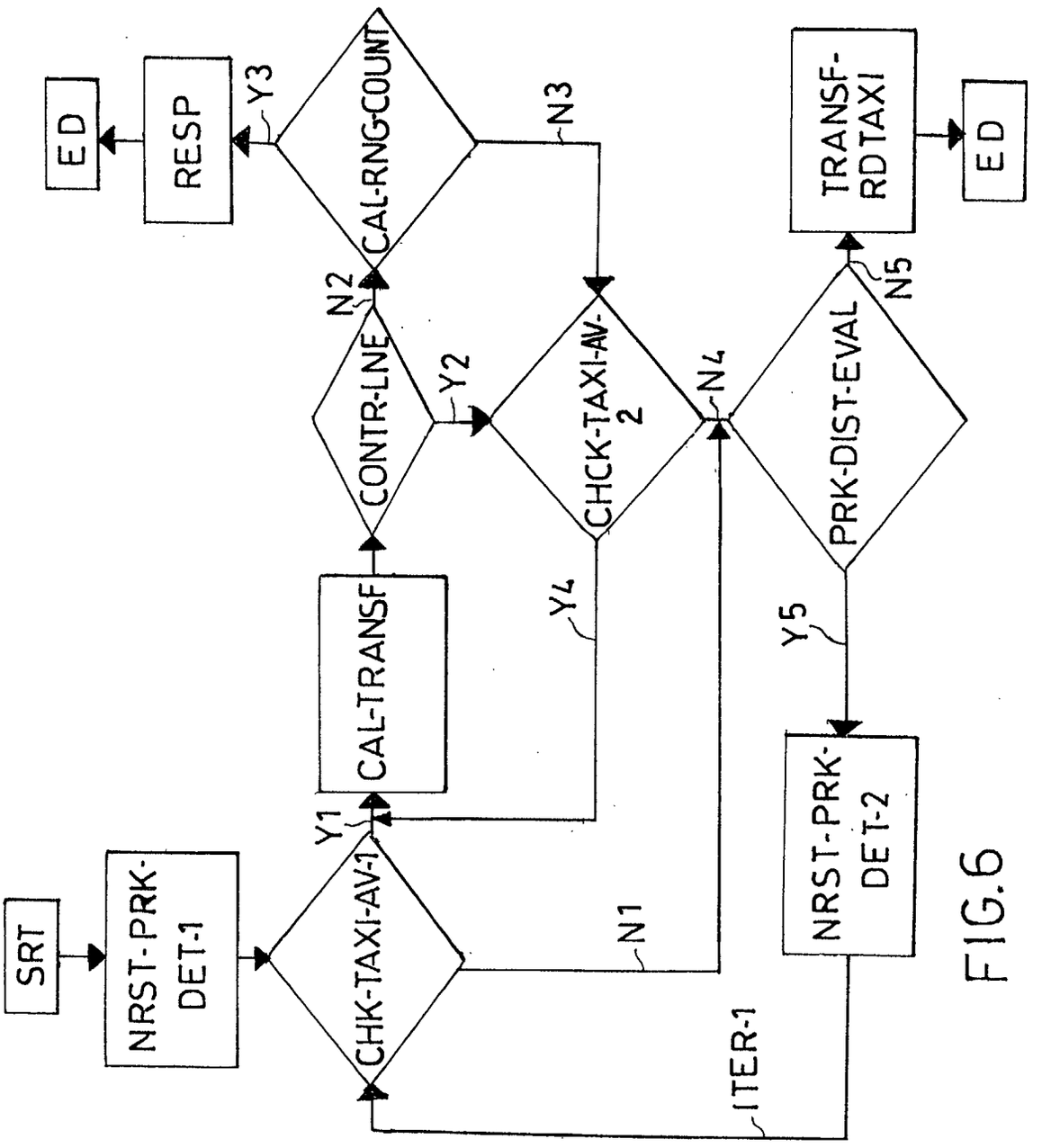
SRT
NRST-PRK-DET-1
CHK-TAXI-AV-1
Y1
CAL-TRANSF
CONTR-LNE
N2
Y2
CHCK-TAXI-AV-2
N4
PRK-DIST-EVAL
N5
Y5
NRST-PRK-DET-2
TRANSF-RD TAXI
E D
CAL-RNG-COUNT
N3
Y3
RESP
E D
N1
Y4
ITER-1

FIG.6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 83 0642

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 44 29 852 A (DAIMLER BENZ AG) 29 February 1996 (1996-02-29)	1,2, 9-12, 17-20, 24,26	G08G1/127
A	* the whole document *	3,8,25	
X	FR 2 776 804 A (LEJEUNE PIERRE MARIE EUGENE) 1 October 1999 (1999-10-01)	1-3,17, 19-21, 23,26	
A	* abstract * * page 3, line 25 - page 6, line 18 * * page 8, line 7 - line 35 * * page 10, line 24 - line 33 * * page 12, line 12 - line 14 * * page 13, line 14 - line 17 * * page 14, line 7 - page 15, line 35 *	4,7-9,18	
X	EP 1 067 498 A (HONDA MOTOR CO LTD ;UNIV CALIFORNIA (US)) 10 January 2001 (2001-01-10)	1,11,12, 17-21, 23,26	
A	* abstract * * column 7, line 6 - column 8, line 10; figure 1 * * column 21, line 25 - column 22, line 46; figures 6-8 * * column 24, line 53 - column 25, line 13; figure 9 *	2,3	TECHNICAL FIELDS SEARCHED (Int.Cl.7) G08G
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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Application Number
EP 01 83 0642

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