

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 May 2006 (04.05.2006)

PCT

(10) International Publication Number
WO 2006/045678 A1

(51) International Patent Classification⁷: **G08G 1/01**,
1/123, G07B 15/00, G07C 5/00, G06F 17/00

(21) International Application Number:
PCT/EP2005/054783

(22) International Filing Date:
23 September 2005 (23.09.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0423793.9 27 October 2004 (27.10.2004) GB

(71) Applicant (for all designated States except US): **INTERNATIONAL BUSINESS MACHINES CORPORATION** [US/US]; New Orchard Road, Armonk, New York 10504 (US).

(71) Applicant (for MG only): **IBM UNITED KINGDOM LIMITED** [GB/GB]; P.O. Box 41, North Harbour, Portsmouth, Hampshire PO6 3AU (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **DARE, Peter, Roy** [GB/GB]; 1 Willow Gardens, Liphook, Hampshire GU30 7HY (GB).

(74) Agent: **LING, Christopher, John**; IBM United Kingdom Limited, Intellectual Property Law, Hursley Park, Winchester, Hampshire SO21 2JN (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

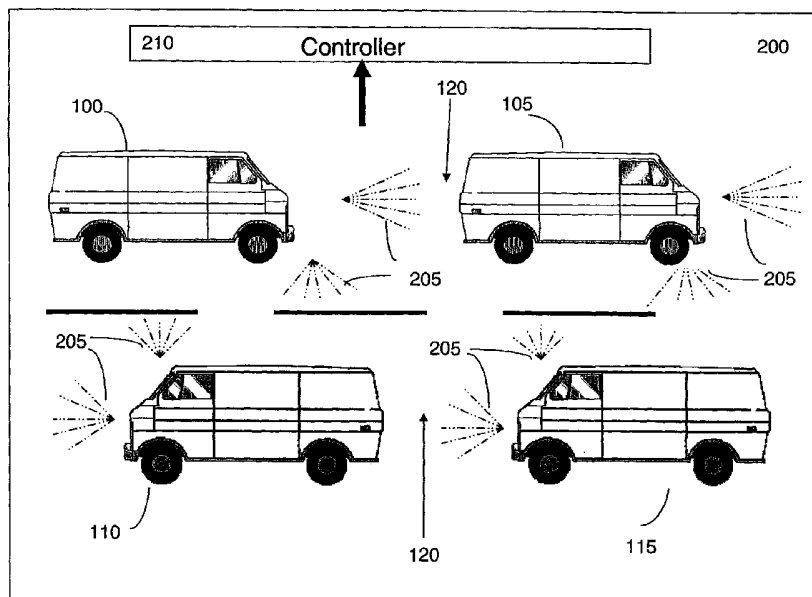
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A METHOD AND SYSTEM FOR GATHERING AND PROCESSING DATA FOR ROAD USE CHARGING



(57) Abstract: A method, system and computer program product for the gathering and processing of data from a plurality of vehicles. Each vehicle broadcasts data indicative of itself and its position and detects other broadcasts from other vehicles. Each encounter is recorded in a record for uploading to a road use charging authority. On receipt of the record, the charging authority 200 calculates the road use charge for the vehicle from which the encounter record was uploaded and accumulates journey information for the vehicles which the uploading vehicle claims to have encountered and detects anomalies within the uploaded records.

WO 2006/045678 A1

**A METHOD AND SYSTEM FOR GATHERING
AND PROCESSING DATA FOR ROAD USE CHARGING**

Field of the Invention

The invention relates to the field of traffic management systems and in particular to a method and a system for gathering and processing data for road use charging.

Background of the Invention

The benefits of road user pricing have been set out in numerous government documents within the UK and other countries. As an alternative to tolls, annual road taxes and fuel duties, road user pricing holds the promise of less traffic congestion, less environmental pollution, greater fairness, safer roads and better use of infrastructure resources.

Road user pricing may command general support, provided the privacy and fairness issues are solved. Privacy relates to the ability of a driver to choose to pay the proper price for a journey without being identified. Fairness relates to the difficulty of a dishonest driver avoiding payment without detection. Cost and environmental considerations may also be issues, particularly the cost and environmental impact of roadside equipment.

Known solutions generally fail to address satisfactorily the privacy, fairness, cost and environmental issues. Typically, such solutions are based on the installation in each vehicle of tamper-proof equipment, usually centered on a smart card issued by or on behalf of the highway authority, which records the journey made by each vehicle. Roadside equipment interacts with the onboard equipment to check that the onboard equipment is operating properly. The driver uploads the information on the smart card in order to be invoiced.

The drawbacks of the above approaches are a) it is not advisable to store data collected from the vehicles under the control of the users of the vehicles and b) the impossibility of tamper-proofing onboard units can lead to fraudulent recording and delayed reporting. A post-paying driver expecting a large bill can "lose" an on board unit smart card. If the charge for losing a card is larger than the maximum cost of the journeys that might have taken place, genuine loss/damage is unfairly penalized.

The deposit on a pre-payment card must be equally large, as a pre-paid on board unit smart card has no way of knowing when it is overspent, but might switch off after a predetermined amount of time or once a certain distance has been recorded.

The benefit of privacy-preserving technologies is severely restricted by the need to process the data pertaining to a vehicle's movement through a charging algorithm in a data centre. Both pre and post-payment methods are affected.

Expensive and intrusive roadside equipment is necessary for enforcement. Equipment must be deployed pervasively before a non-pilot scheme begins. The effectiveness of this approach in detecting evasion is limited.

Disclosure of the Invention

Viewed from a first aspect, the present invention provides a method for the gathering of data from a plurality of vehicles, for use by a road use charging authority, comprising the steps of: periodically broadcasting data indicative of a vehicle and the vehicle's position for detection by other vehicles in the vehicle's vicinity; detecting data indicative of other vehicles in the vehicle's vicinity; and generating a record, the record comprising data gathered from the broadcasting step and the detecting step, which is periodically sent to a controller, at which, a determination is performed, as to whether records from other vehicles which have encountered the vehicle have been sent to the controller.

The present invention assumes that a road use charging authority imposes a charging tariff which encourages vehicles to record encounters and that a sufficient proportion of vehicles are diligent recording encounters.

The charging authority computes the charge payable, collects the charge from the owner of the vehicle, takes its percentage and passes the remainder of the revenue to the highway authority. Discounts would encourage early upload/payment. The charging system would also pass the uploaded encounter record to the enforcement system. The invention is self-enforcing to the extent that pricing discounts encourage diligent early uploading.

Preferably, the invention provides a method wherein the data indicative of the vehicle is determined by communicating with an onboard smart card unit.

5 Preferably, the present invention provides a method wherein the positional data is determined by communicating with a location determination device.

10 Preferably, the present invention provides a method wherein the gathered data comprises, the registration details, positional data and the time of the vehicle's encounter and the registration details of the other vehicle within the encounter.

15 Preferably, the present invention provides a method wherein the broadcast data comprises a digital signature.

20 Viewed from a second aspect the present invention provides a method for detecting anomalies in data gathered from a plurality of vehicles, by a road use charging authority, comprising the steps of: receiving a record from a vehicle, the record comprising data indicative of the vehicle and its position and data indicative of other vehicles which have encountered the vehicle within the vehicle's vicinity; and determining if records from other vehicles which have encountered the vehicle have been received by the controller.

25 Preferably, the present invention provides a method wherein on determining records from other vehicles which have encountered the vehicle and have been received by the controller, the vehicle's record and the other vehicles' records are deleted from a data store.

30 Preferably, the present invention provides a method wherein on determining records from other vehicles which have encountered the vehicle and have been received by the controller, the vehicle's record and the other vehicle's records are excluded from the charging process.

35 Preferably, the present invention provides a method wherein the determining step further comprises storing the vehicle's record in a second data store, if records from other vehicles which have encountered the vehicle have not been received by the controller.

40 Preferably, the present invention provides a method further comprising analyzing the vehicle's record, stored in the second data

store, to obtain information pertaining to the other vehicle, involved in an encounter, whose record has not been received by the controller.

Preferably, the present invention provides a method wherein the identifying step is performed after a time period has lapsed.

Preferably, the present invention provides a method wherein the identified information comprises the other vehicle's registration details.

Preferably, the present invention provides a method wherein a notification is communicated to an entity of the other vehicle as determined by the other vehicle's registration details.

Viewed from a third aspect the present invention provides a computer program product loadable into the internal memory of a digital computer, comprising software code portions for performing, when said product is run on a computer, to carry out the invention of claims 1 to 13.

Viewed from a forth aspect the present invention provides a road use charging service for detecting anomalies in data gathered from a plurality of vehicles, the service comprising the steps of: receiving a record from a vehicle, the record comprising data indicative of the vehicle and its position and data indicative of other vehicles claiming to have encountered the vehicle within the vehicle's vicinity; determining if records from other vehicles which have encountered the vehicle have been received by the controller; and on detection of records not being received from other vehicles, asserting a charge on the detected vehicles.

Preferably, the present invention provides a service, wherein the asserted charge is a higher charge for the detected vehicles and a lower charge for the vehicle's for which records have been received.

Viewed from a fifth aspect, the present invention provides a system for the gathering of data from a plurality of vehicles, for use by a road use charging authority, the system comprising: a broadcasting component for periodically broadcasting data indicative of a vehicle and the vehicle's position for detection by other vehicles in the vehicle's vicinity; a detector component for detecting data indicative of other vehicles in the vehicle's vicinity; and a generator for generating a record, the record comprising data gathered from the broadcasting step and the detecting step, which is periodically sent to a controller, at which,

a determination is performed, as to whether records from other vehicles which have encountered the vehicle have been sent to the controller.

Preferably, the present invention provides a system wherein the data indicative of the vehicle is determined by means for communicating with an onboard smart card unit.

Preferably, the present invention provides a system wherein the positional data is determined by means for communicating with a location determination device.

Preferably, the present invention provides a system wherein the gathered data comprises, the registration details, positional data and the time of the vehicle's encounter and the other vehicle's registration details.

Preferably, the present invention provides a system wherein the broadcast data comprises a digital signature.

Viewed from a sixth aspect the present invention provides a system for detecting anomalies in data gathered from a plurality of vehicles, by a charging authority, comprising: a receiver, for receiving a record from a vehicle, the record comprising data indicative of the vehicle and its position and data indicative of other vehicles claiming to have encountered the vehicle within the vehicle's vicinity; and a determiner, for determining if records from other vehicles which have encountered the vehicle have been received by the controller.

Preferably, the present invention provides a system wherein on determining if records from other vehicles which have encountered the vehicle have been received by the controller, comprises means for the vehicle's record and the other vehicles' records being deleted from a data store.

Preferably, the present invention provides a system wherein the determiner further comprises means for storing the vehicle's record in a second data store, if the records from other vehicles which have encountered the vehicle have not been received by the controller.

Preferably, the present invention provides a system further comprising analyzing the vehicle's record, stored in the second data

store, to extract information pertaining to the other vehicle, involved in an encounter, whose record has not been received by the controller.

Preferably, the present invention provides a system, wherein the identifying step is performed after a time period has lapsed.

Preferably, the present invention provides a system wherein the identified information comprises the other vehicle's registration details.

Preferably, the present invention provides a system wherein a notification is communicated to a responsible entity of the other vehicle as determined by the other vehicle's registration details.

Brief description of the drawings

Embodiments of the invention are described below in detail, by way of example only, with reference to the accompanying drawings in which:

Figures 1a and 1b, illustrates a number of prior art road charging mechanisms;

Figure 2, illustrates the road use charging system of the present invention;

Figure 3, illustrates the sub components of the road use charging system located within a vehicle;

Figure 4, illustrates the sub components of the road use charging system of the charging authority;

Figure 5, illustrates the operational steps of the road use charging system located within a vehicle; and

Figure 6, illustrates the operational steps of the road use charging system of the charging authority.

Detailed description of the Invention

Figures 1a and 1b show a number of prior art road charging mechanisms. In figure 1a, two vehicles 100, 105 are traveling along a road 120 towards an area of vehicle congestion. As the vehicles' enter into the area of vehicle congestion, a camera 125 is located along the side of the

road, in order to take a photograph of the vehicle's 100, 105 registration plate. On receipt of the photograph, the registration plate details are extracted and a query is performed in a database to locate the registered owner of the vehicle 100, 105. Once the registered owner is located, a bill for the amount of the congestion charge is sent to the registered owner. Alternatively, an owner of a vehicle 100, 105 can pay in advance to the charging authority. Each time the vehicle 100, 105 enters into the congestion charging area, the amount of the congestion charge is debited from the amount of money that was paid in advance to the charging authority.

Figure 1b shows two vehicles 110, 115 traveling along a road 120 towards a toll booth 130. Toll booths 130 are often found along roads where a charging authority feels that is appropriate to charge for the use of the road. This may be because the charging authority wishes to gain back revenue that was spent on building the road 120, or where, by applying a charge to the use of the road 120, traffic congestion will be reduced. Toll booths require an infrastructure to be placed across a road 120, in order to stop vehicles 110, 115 traveling along a road 120 until the vehicles 110, 115 have paid a fee.

In each of the examples above, the charging authority provide no provision for the privacy of the information pertaining to the registered owner of a vehicle. Further, particularly with reference to Figure 1a, vehicle owners are extremely unhappy and wary of having their private details, for example, the location of a vehicle at a particular time, captured, stored and used without any personal control over the use of the information.

A charging system 200 is shown in Figure 2, which provides a method and system for road use charging. As is shown in Figure 2, the charging system 200 does not require any installation of roadside equipment or tamper-proof onboard equipment, apart from, preferably, a smartcard.

As is shown in Figure 2, each vehicle 100 to 115 is required to broadcast 205 periodically, by for example, short range radio, its position and registration details. Preferably, the broadcast comprises a digital signature, for digitally signing the broadcast, in such a manner that the digital signature provides assurance that the driver or owner of the vehicle may be identified.

The vehicle 110 - 115 may broadcast 205 other information indicative of itself, for example, the vehicle's speed, direction and the time of the day. Alternatively, when operating in a road use charging environment, a charging band may also be broadcast 205. A charging band may comprise banding vehicles 100-115 according to their emission type.

In order to determine the position, speed, bearing and a time of day for a vehicle 100-115, an onboard processing device, for example, a smart card, communicates with a GPS system for determining the speed, the date and time of the vehicle 100-115.

The road use charging system 200 may broadcast 205 a radio signal over a predetermined time period. Over what time period the radio signal may be broadcasted and when, may be determined by, the distance traveled by the vehicle, how long the vehicle has been traveling for, or alternatively, when the vehicle travels into a zone. For example, a geographical region may be divided into areas, each area measuring, for example, 200 meters square. As a vehicle enters a zone, the vehicle may broadcast its data. As a vehicle leaves one zone and moves into another zone, the vehicle, once again, may broadcast its data.

A vehicle 100-115 not broadcasting 205 the correct information, or not broadcasting 205 at all, will be deterred by the possibility of detection by police or other vehicles 100 to 115 and of consequent prosecution for a road traffic or tax evasion offence.

As well as broadcasting 205 information, each vehicle 110-115 is required to detect and receive information broadcasted 205 from other vehicles. Each vehicle 100-115 is required to detect and receive broadcasted information 205 periodically. Preferably, each vehicle 110-115 is required to negotiate with other vehicles 110-115 within its vicinity. Preferably, a vehicle 'pairs' with the vehicle broadcasting immediately before it, in its vicinity in order to establish an encounter.

The vicinity may be defined by a charging authority, for example by using grid references to denote charging areas. Each vehicle 110-115 negotiates with a nearby vehicle 110-115 to establish an "encounter". Failure to participate, or not to attempt to participate, in this interaction may be considered as a road traffic or tax evasion offence. A vehicle 110-115 may refuse to establish an encounter with another vehicle 110-115 whose position co-ordinates are not credible, for example, another vehicle that is not within a few tens of metres of its own vehicle. Once

an encounter has been determined, preferably, a record is generated. The record may be stored for a number of days, weeks or months before uploading to the charging authority 200. The record may comprise the broadcasted data and the data received from other vehicles for transmitting to the charging authority 210. On receipt of the data, the charging authority 200 calculates the road use charge for the vehicle from which the data that was uploaded, accumulates journey information for the vehicles, which the uploading vehicle claims to have encountered, so that they too can in due course be charged and detects anomalies within the uploaded records. For example, a Vehicle A may establish an encounter with a Vehicle B. Vehicle A uploads its record so that Vehicle A is charged, but also, so that Vehicle B is charged.

The record may comprise data indicative of a series of encounters recorded throughout a journey, time period or a zone, or alternatively, just one encounter. A part of a record may be uploaded, for example, data indicative of a few encounters, or all of a record may be uploaded. The record may be uploaded by the owner of the vehicle, the driver or anyone else. The record may be uploaded via a smartcard.

Moving on to Figure 3, the components that form the charging system 200 as located within a vehicle 100-115 are shown. The components comprise a broadcast component 305 for broadcasting information indicative of the vehicle's 100 position, speed, direction and charging band etc, a detector component 310 for detecting information broadcasted 205 from other vehicles 105,110,115 in the vehicle's 100 vicinity, a processing component 315 for processing the encounter record between two vehicles 110, 115, and a generator component 320 for generating a record pertaining to the encounter.

The broadcast 305 component broadcasts information indicative of the vehicle's position and, for example, its speed, direction, charging band and a digital signature etc. The broadcasted information can be any information that a charging authority 210 requires to ensure a fair charging policy. The broadcasting component 305 receives data from a GPS system for receiving a set of GPS coordinates pertaining to the vehicle's (100) speed and position. The broadcast component 305 further communicates with a vehicle's GPS system, for requesting and receiving information pertaining to the current date and time. Once the information has been gathered the broadcast component 305 packages the received information into a payload for broadcasting via a radio wave mechanism for receiving by another vehicle 105, 110, 115 in its vicinity. The detector component

310 detects other payloads from other vehicles 105,110,115 within its vicinity. On receipt of a payload from another vehicle 105,110 115, the detector component 310 communicates to the processing component 315 to signal that a payload, (signifying an encounter) has been received.

The generator component 320 records the time of the encounter, the positional co-ordinates of both vehicles 110, 115 and the registration details and/or the digital signature of the other vehicle 110. In another embodiment, the charging band of the other vehicle 110, and the speed and bearing of both vehicles 110, 115 may also be recorded.

At a convenient time, for example, when the vehicle 100 is being refueled, the vehicle driver will upload the encounter record to a charging system. Such an upload could be anonymous, for example, when paying cash at a refueling station. All encounter records may be uploaded or just a subset of encounter records may be uploaded.

The charging authority 210 receives the uploaded encounter records and processes each encounter record to detect any anomalies. These steps are explained with reference to Figure 4, which illustrates the individual components of the charging system of the charging authority 210. A receiver component 400 receives the uploaded encounter records and performs a check to ensure that the uploaded encounter records comprise the correct information. For example, that the positional co-ordinates are valid co-ordinates etc. The uploaded encounter records are communicated to a collator component 405 for queuing for communicating to a recorder component 415 for storing in a temporary data store 420. A determiner component 410 examines each encounter record.

For each encounter, the determination component 410 determines whether another vehicle 110 has already uploaded its appropriate encounter record. If the appropriate encounter record is determined to have already been uploaded the corresponding encounter record is discounted from the charging process and preferably deleted irrevocably, in order to preserve privacy. If the determiner component 410 determines that the corresponding encounter record has not been previously uploaded, the encounter record is stored in a temporary database 420. The privacy properties derive from the temporary nature of the data in the temporary database, and the irrevocable deletion of entries.

It will be appreciated by a person skilled in the art that the above components may function in any order and the order is not limited to the order as disclosed above.

After a designated period of time, the determiner component 410 performs a query in the temporary database 420 to determine a set of records that have, over the designated period of time, not had a corresponding encounter record uploaded i.e. an earlier paid broadcast uploaded. For example, encounter record A from vehicle 100 is uploaded to the charging authority 210. The encounter record states that an encounter was recorded between vehicle B 110. The encounter record can be used to identify and thus contact the driver or the registered owner of vehicle B 110. The determiner component 410 determines after a period of time that no corresponding encounter record was uploaded for vehicle B 110. In another embodiment owners of vehicles 110-115 who promptly upload their encounter records are rewarded by being given a discounted rate of road charge. Conversely, owners of vehicles who are not diligent in uploading their encounter records may be penalized by being charged at an undiscounted rate.

The operational steps of the charging system will now be explained with reference to Figure 5 and 6.

As a vehicle 110 travels along a route 120, the broadcast component 305, gathers information indicative of the vehicle and its position. The broadcast component 305 broadcasts 205 the information to other vehicles 105,110,115 within its vicinity over a predetermined amount of time, at step 500. A detector component 310 detects other vehicles 105,110,115 broadcasting 205 information within the vehicle's 100 vicinity, at step 505. The detector component 310 receives the broadcasted information pertaining to the detected vehicle, at step 510 and signals to the processing component 315 to process the encounter record.

An example of an encounter records is as follows:

Encounter record

Vehicle A (ref numeral 100)	
Date and time	15/10/2008 12:00:01
Positional coordinates	UK 413000 241550
Charging band	A 154 gm/km

Vehicle B (reference numeral 110)	
Date and time	15/10/2008 12:00:00
Positional coordinates	UK 413200 241590
Digital signature	x'A123456789...

5 An encounter record comprises data pertaining to two vehicles 100, 110 which have broadcasted information about themselves. The first line of the encounter record comprises data pertaining to the vehicle 100 that has generated the encounter record. This is always the vehicle 100 that
10 broadcasted information indicative of itself and in response detected broadcasted data from other vehicles 110. The encounter record may comprise the date and time of the encounter between vehicle 100 and the vehicle 110, the positional coordinates of the vehicle 100 and the charging band of the vehicle 100, if appropriate. Following these details, are the details broadcasted from another vehicle 110, in this example vehicle B 110. The details pertaining to vehicle B 110 may
15 comprise the date and time of the encounter, the positional coordinates of the vehicle at the date and time of the encounter and the digital signature of vehicle B's broadcasted data. It will be appreciated by a person skilled in the art the other information may be recorded in an encounter record.

20 The encounter record is uploaded to the charging authority 210. With reference to Figure 6, the receiver component 400 receives the encounter record at step 600 and passes the encounter record to the collator component 405 for checking whether the information is correct, in the appropriate format and for extracting the details about the entity that
25 should be charged for road use. Control moves to control 610 and the determiner component 410 determines whether a corresponding encounter record has been stored in the temporary data store 420. If the determination is positive (i.e. an encounter record has been located), control passes to step 615 and the encounter record is either excluded
30 from the charging process or deleted from the temporary data store 420. If the determination is negative (i.e. an encounter record has not been located), control moves to step 620 and the encounter record is stored in a temporary data store 420.

35 After a predetermined amount of time has passed, the determination component 410 performs a query on the temporary data store 420 and

identifies which encounter records have not had a corresponding encounter record uploaded to the charging authority 210, at step 625.

CLAIMS

1. A method for the gathering of data from a plurality of vehicles, for use by a road use charging authority, comprising the steps of:

periodically broadcasting data indicative of a vehicle and the vehicle's position for detection by other vehicles in the vehicle's vicinity;

detecting data indicative of other vehicles in the vehicle's vicinity; and

generating a record, the record comprising data gathered from the broadcasting step and the detecting step, which is periodically sent to a controller, at which, a determination is performed, as to whether records from other vehicles which have encountered the vehicle have been sent to the controller.

2. A method as claimed in claim 1 wherein the data indicative of the vehicle is determined by communicating with an onboard processing device.

3. A method as claimed in claim 1 wherein the positional data is determined by communicating with a location determination device.

4. A method as claimed in claim 1 wherein the gathered data comprises, the registration details, positional data and the time of the vehicle's encounter and the registration details of the other vehicle within the encounter.

5. A method as claimed in claim 1 wherein the broadcast data comprises a digital signature.

6. A method for detecting anomalies in data gathered from a plurality of vehicles, by a road use charging authority, comprising the steps of:

receiving a record from a vehicle, the record comprising data indicative of the vehicle and its position and data indicative of other vehicles which have encountered the vehicle within the vehicle's vicinity; and

determining if records from other vehicles which have encountered the vehicle have been received by the controller.

7. A method as claimed in claim 6 wherein on determining records from other vehicles which have encountered the vehicle and have been received by the controller, the vehicle's record and the other vehicles' records are deleted from a data store.

8. A method as claims in claim 6 wherein on determining records from other vehicles which have encountered the vehicle and have been received by the controller, the vehicle's record and the other vehicle's records are excluded from the charging process.

9. A method as claimed in claim 6 wherein the determining step further comprises storing the vehicle's record in a second data store, if records from other vehicles which have encountered the vehicle have not been received by the controller.

10. A method as claimed in claim 9 further comprises analyzing the vehicle's record, stored in the second data store, to obtain information pertaining to the other vehicle, involved in an encounter, whose record has not been received by the controller.

11. A method as claimed in claim 10, wherein the identifying step is performed after a time period has lapsed.

12. A method as claimed in claim 10 wherein the identified information comprises the other vehicle's registration details.

13. A method as claimed in claim 12 wherein a notification is communicated to an entity of the other vehicle as determined by the other vehicle's registration details.

14. A computer program product loadable into the internal memory of a digital computer, comprising software code portions for performing, when said product is run on a computer, to carry out the invention of claims 1 to 13.

15. A road use charging service for detecting anomalies in data gathered from a plurality of vehicles, the service comprising the steps of:

receiving a record from a vehicle, the record comprising data indicative of the vehicle and its position and data indicative of other vehicles claiming to have encountered the vehicle within the vehicle's vicinity;

determining if records from other vehicles which have encountered the vehicle have been received by the controller; and

on detection of records not being received from other vehicles,
asserting a charge on the detected vehicles.

16. A service as claimed in claim 15, wherein the asserted charge is a higher charge for the detected vehicles and a lower charge for the vehicle's for which records have been received.

17. A system for the gathering of data from a plurality of vehicles, for use by a road use charging authority, the system comprising:

a broadcasting component for periodically broadcasting data indicative of a vehicle and the vehicle's position for detection by other vehicles in the vehicle's vicinity;

a detector component for detecting data indicative of other vehicles in the vehicle's vicinity; and

a generator for generating a record, the record comprising data gathered from the broadcasting step and the detecting step, which is periodically sent to a controller, at which, a determination is performed, as to whether records from other vehicles which have encountered the vehicle have been sent to the controller.

18. A system as claimed in claim 17 wherein the data indicative of the vehicle is determined by means for communicating with an onboard smart card unit.

19. A system as claimed in claim 18 wherein the positional data is determined by means for communicating with a location determination device.

20. A system as claimed in claim 17 wherein the gathered data comprises, the registration details, positional data and the time of the vehicle's encounter and the other vehicle's registration details.

21. A system as claimed in claim 17 wherein the broadcast data comprises a digital signature.

22. A system for detecting anomalies in data gathered from a plurality of vehicles, by a charging authority, comprising:

5 a receiver, for receiving a record from a vehicle, the record comprising data indicative of the vehicle and its position and data indicative of other vehicles claiming to have encountered the vehicle within the vehicle's vicinity; and

10 a determiner, for determining if records from other vehicles which have encountered the vehicle have been received by the controller.

23. A system as claimed in claim 22 wherein on determining if records from other vehicles which have encountered the vehicle have been received by the controller, comprises means for the vehicle's record and the other
15 vehicles' records being deleted from a data store.

24. A system as claimed in claim 22 wherein the determiner further comprises means for storing the vehicle's record in a second data store, if the records from other vehicles which have encountered the vehicle have
20 not been received by the controller.

25. A system as claimed in claim 24 further comprises analyzing the vehicle's record, stored in the second data store, to extract information pertaining to the other vehicle, involved in an encounter, whose record
25 has not been received by the controller.

26. A system as claimed in claim 25, wherein the identifying step is performed after a time period has lapsed.

30 27. A system as claimed in claim 25 wherein the identified information comprises the other vehicle's registration details.

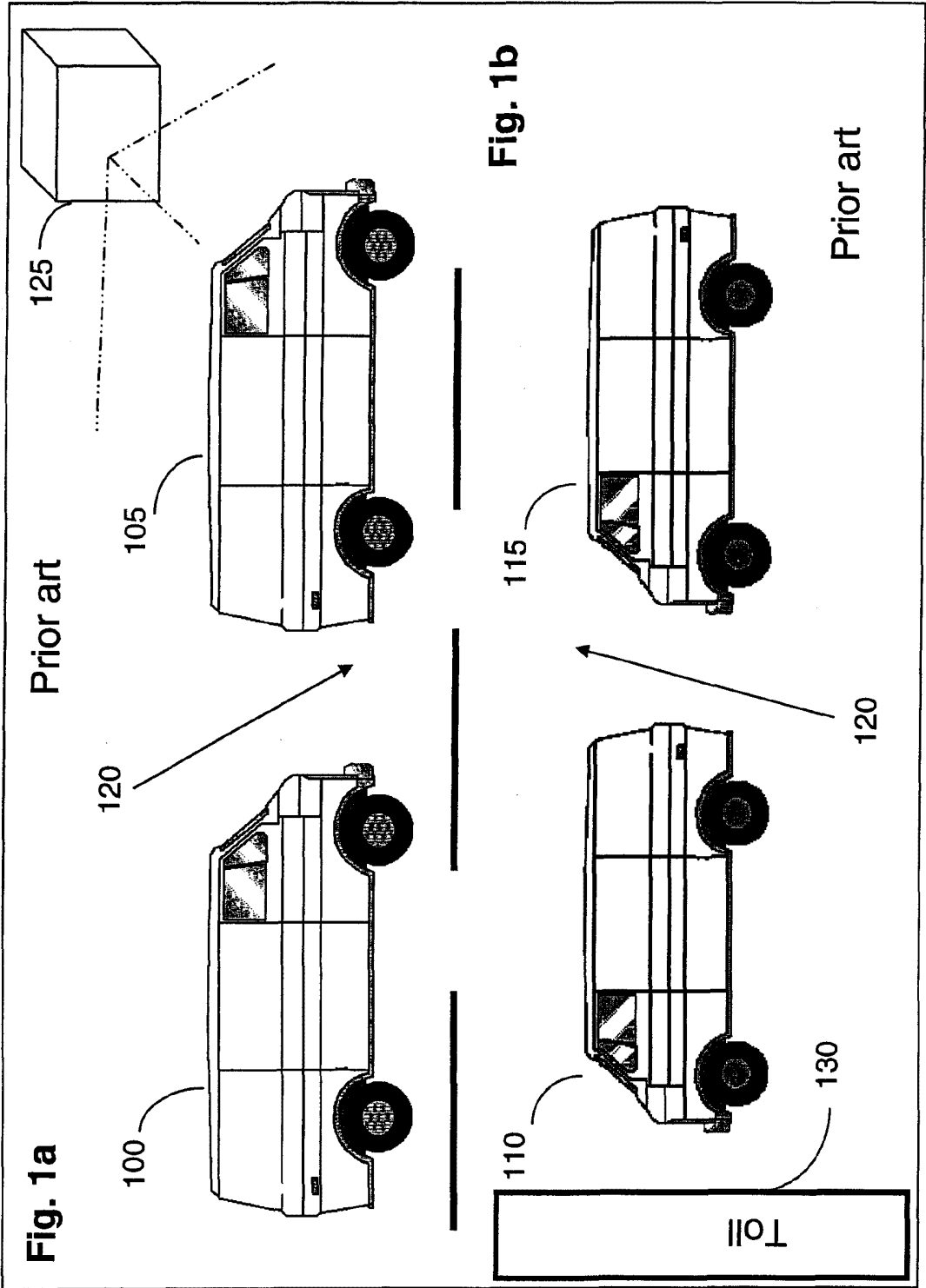
28. A system as claimed in claim 27 wherein a notification is communicated to a responsible entity of the other vehicle as determined by
35 the other vehicle's registration details.

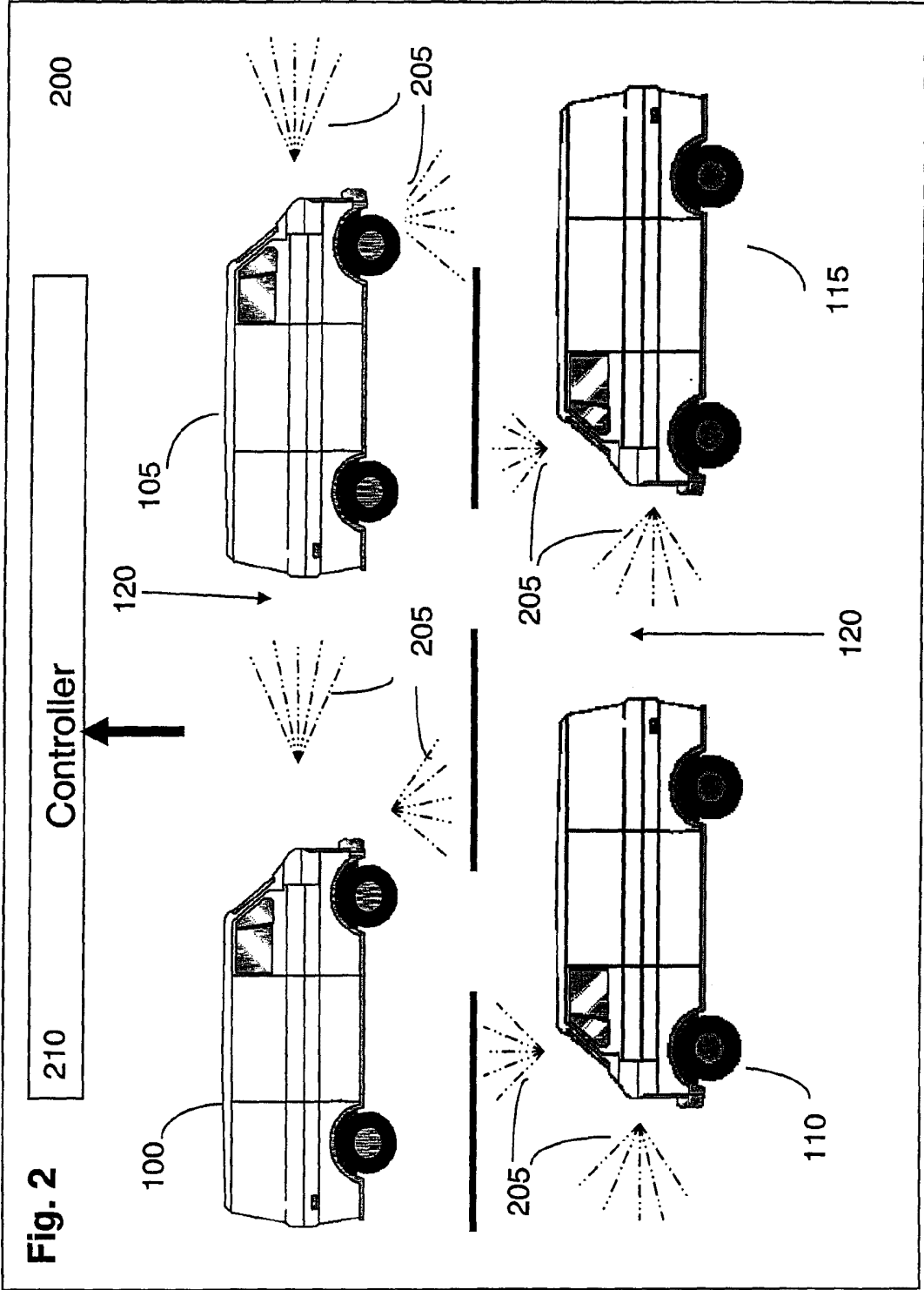
29. An information processing device for broadcasting data indicative of a vehicle and its position; and detecting data indicative of other vehicles within the vehicle's vicinity, for the inclusion into the record
40 of claim 1.

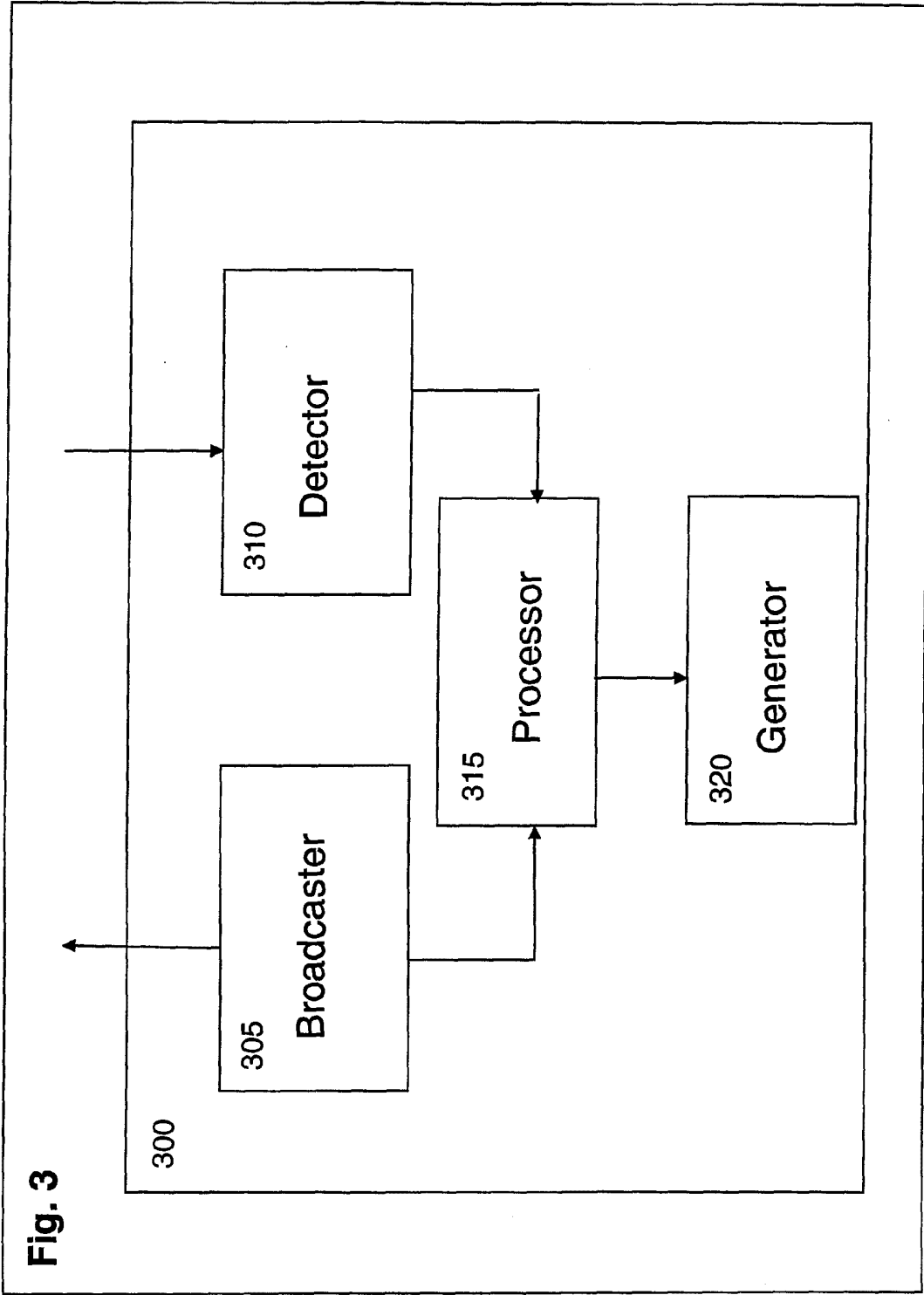
30. An information processing device of claim 29, wherein the information storage device is adapted for use in a vehicle.

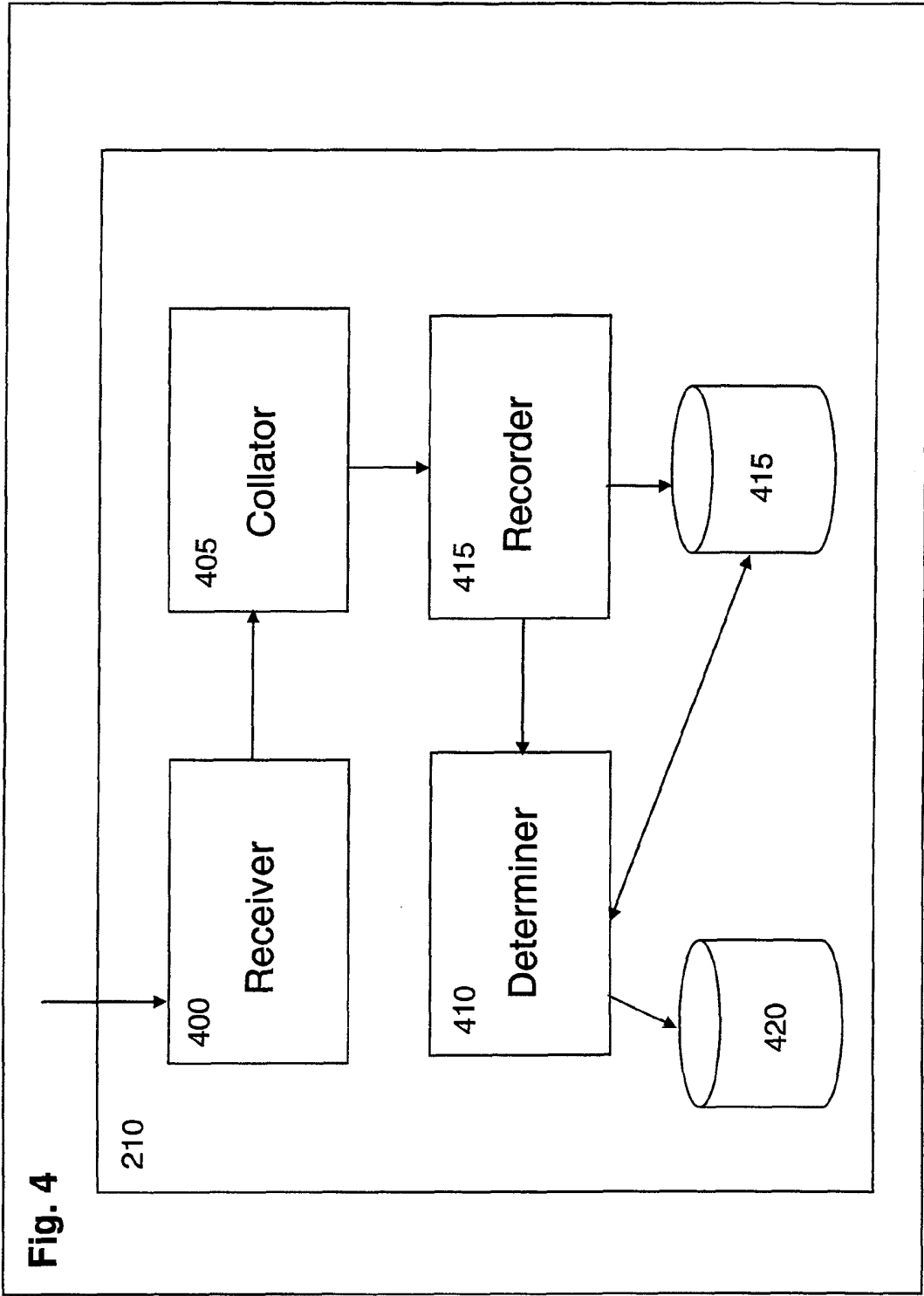
5 31. An information storage device as claimed in claim 29, wherein the information storage device is a smart card.

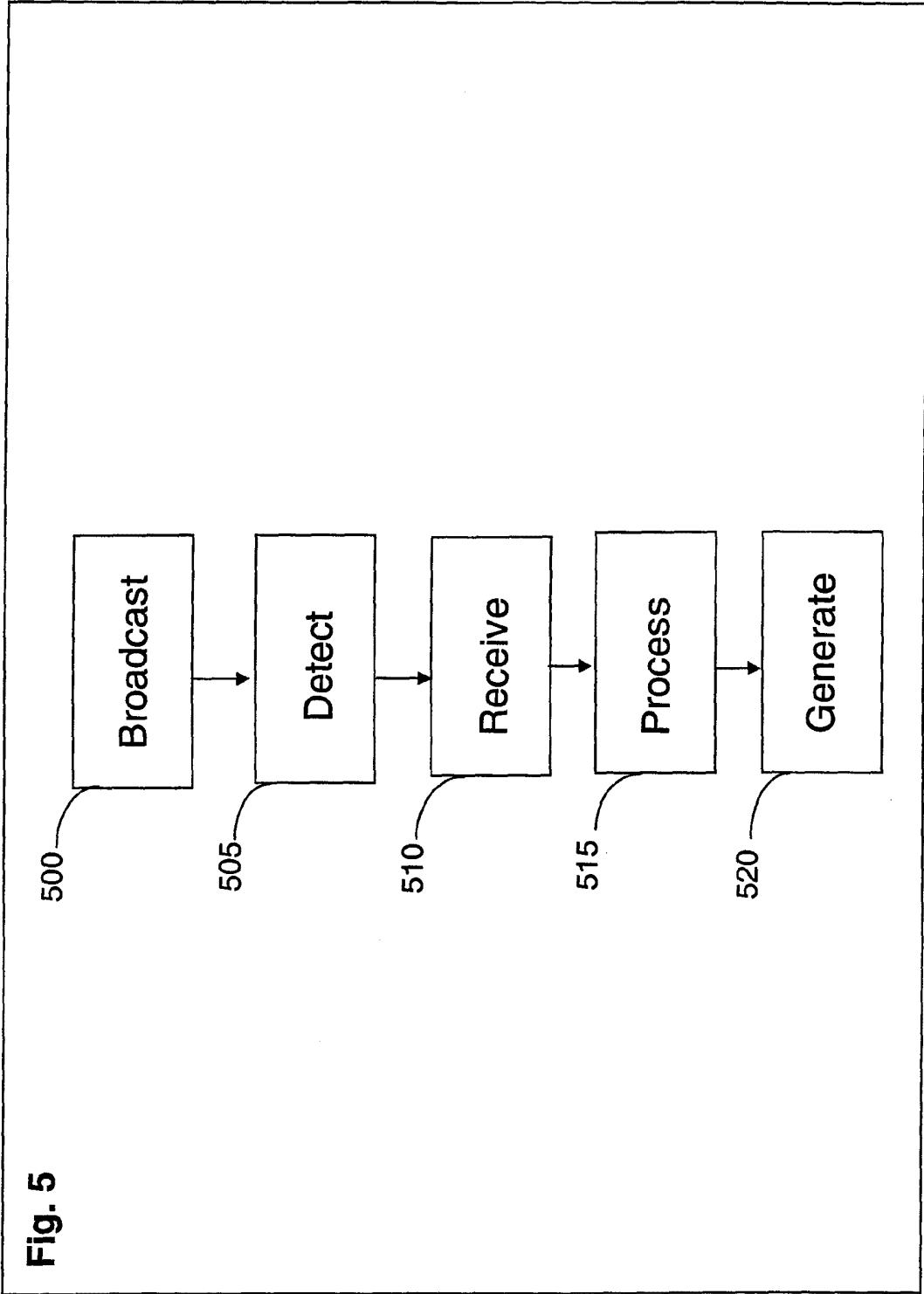
32. A vehicle adapted for receiving an onboard processing device for performing the steps of claim 1.

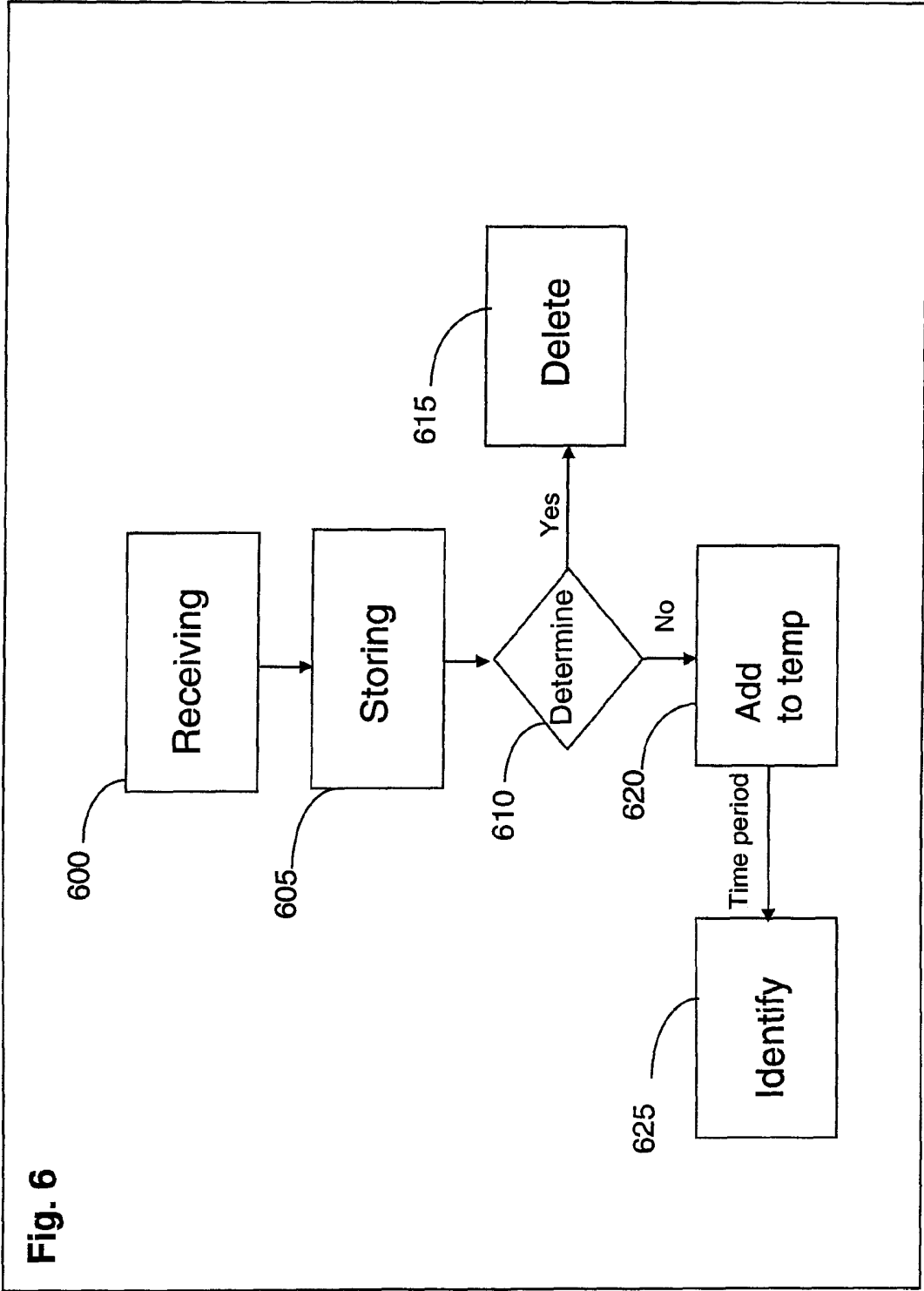












INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP2005/054783

A. CLASSIFICATION OF SUBJECT MATTER

G08G1/01 G08G1/123 G07B15/00 G07C5/00 G06F17/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G08G G07B G07C G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 101 31 841 A1 (WISSENSCHAFTLICHE WERKSTATT FUER UMWELTMESSTECHNIK GMBH) 16 January 2003 (2003-01-16) the whole document	1-32
A	US 2004/093289 A1 (BODIN WILLIAM KRESS) 13 May 2004 (2004-05-13) the whole document	1-32

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

S document member of the same patent family

Date of the actual completion of the international search

28 November 2005

Date of mailing of the international search report

06/12/2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Seisdedos, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2005/054783

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 10131841	A1	16-01-2003	NONE	
US 2004093289	A1	13-05-2004	NONE	