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(54) **METHODS FOR DETECTING ABSENCE OF PARKING RIGHTS, AND SYSTEM THEREFORE**

(57) Method for detecting absence of a parking right for vehicles at a parking facility, the parking facility without exit barrier; the method using a database comprising active parking rights and retro-active parking rights, the method comprising the steps of:
1) identifying vehicles present at the parking facility by retrieving unique identifiers of the vehicles;
2) for each identifier, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles

that do not have an active parking right for parking at the parking facility;
3) identifying a vehicle of the subset as absent from the parking facility to retrieve a subset of vehicles comprising those vehicles of the subset that are absent during a second enforcement action;
4) for the identifiers in the subset, querying the database to retrieve those vehicles of the subset that have not obtained a retro-active parking right;
5) marking the retrieved vehicles.

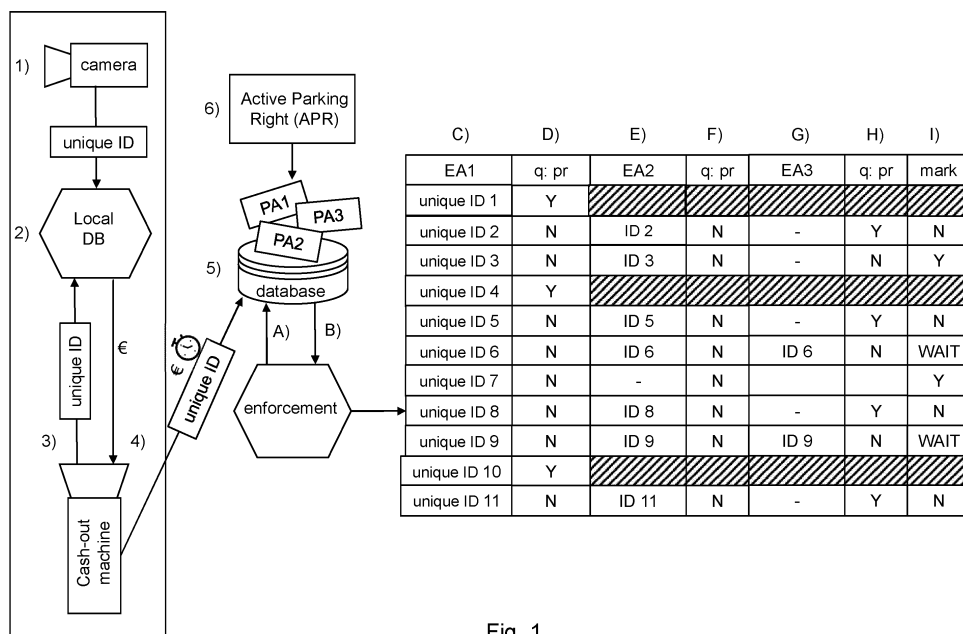


Fig. 1

Description

BACKGROUND

[0001] The present invention relates to methods for detecting absence of parking rights and, more specifically, for marking vehicles that have parked at a parking facility without having obtained a parking right. The present invention also relates to a system for detecting absence of parking rights.

[0002] Such methods are presently known. For example, when one parks in a parking garage, at present a license plate of the vehicle is registered by a camera upon entering the garage and/or a physical barrier prevents one from entering unless a parking ticket is obtained. The driver of the vehicle parks the vehicle, leaves the parking garage, e.g. to go shopping, and upon return pays for his visit based on the parking duration and the relevant hourly rate. The hourly rate typically differs from garage to garage. To pay, the driver of the vehicle offers the ticket obtained at entry to a payment terminal, which terminal determines the amount due to obtain a parking right. Alternatively, the driver may pay by providing the license plate of the parked vehicle to the payment terminal, and the amount due is calculated based upon time of entry registered by the entry camera. Typically, after payment there is a grace period of e.g. 10 or 15 minutes to allow one to leave the parking garage. To prevent vehicle from leaving without having payed, typically there is an exit barrier, e.g. an exit camera or a physical barrier. When an exit camera is used, software may be in place to compare entries and exits, and to determine whether leaving vehicles have obtained a parking right. Vehicles exiting the garage without having obtained a parking right are detected by the exit camera. When a physical barrier is used, the barrier may be able to prevent cars from leaving when no valid, i.e. "paid for" ticket is offered and/or when an exit camera does not recognize the license plate as a "paid for" license plate.

[0003] A disadvantage of such systems is that the exit barrier sometimes malfunctions. When a physical barrier malfunctions, this is rather inconvenient as queues are likely to arise in the parking garage as a result of this malfunctioning (especially when there is just one exit lane). When an exit camera malfunctions, it may be impossible to register (non-)payment and vehicles can leave the parking garage without having paid undetected.

[0004] US 2021/0035439 A1 describes a solution for parking on the side of the street, wherein it is assumed that all parked vehicles have an active parking right. In the method described in US 2021/0035439 A1, information obtained by a first patrol vehicle is stored on a server and accessible to a second, other, patrol vehicle.

[0005] Accordingly, it is an object of the present invention to improve the presently known parking detection methods in view of a possible malfunction of the exit barrier.

SUMMARY OF THE DISCLOSURE

[0006] Therefore, according to a first aspect of the present invention, a method for detecting absence of a parking right for vehicles parked at a parking facility is disclosed,

the parking facility comprising an entrance, an exit and a cash-out machine; a camera being associated with the entrance, the exit without an exit barrier and the cash-out machine for obtaining a parking right near the end of a parking action, based on an entrance logged by the camera;

the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method, the method comprising the steps of:

- 1) in a first enforcement action: identifying one or more vehicle present at the parking facility by retrieving unique identifiers of one or more vehicles;
- 2) for each of the identifiers, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles that do not have an active parking right for parking at the parking facility;
- 3) in a second enforcement action: identifying at least one vehicle of the subset of vehicles as absent from the parking facility to retrieve a subsubset of vehicles comprising those vehicles of the subset that are absent during the second enforcement action, the second enforcement action performed at a later instance than the first enforcement action;
- 4) for each of the identifiers in the subsubset, querying the database to retrieve those vehicles of the subsubset that have not obtained a retro-active parking right in between performing the first and the second enforcement action;
- 5) marking the group of vehicles retrieved in step 4).

[0007] Advantageously, in comparison to parking facilities having exit barriers, by omitting an exit barrier in its entirety the problem of a malfunctioning exit barrier is solved. As explained in the below, with the method as presented herein it is very well possible to detect absence of parking rights even when there is no exit barrier at the parking facility.

[0008] A further advantage of the present method in comparison to parking facilities having exit barriers is that the "locked-up feeling", which is experienced by some people when parking in a parking facility with physical (entry and) exit barriers, can be taken away. This is a direct result of the absence of an exit barrier. Without exit barrier people can to exit the facility at any time. There is no feeling of being locked up.

[0009] A particular advantage compared to the method described in US 2021/0035439 A1 is that through the camera associated with the entrance it can be determined retro-actively which vehicles have entered the parking facility through said entrance. For all these vehicles it can be checked whether they are still present in the parking facility when carrying out an enforcement action and, if not present, whether a parking right has been obtained.

[0010] Further advantageously, the present method can be used at any parking facility having an entrance with a camera, an exit without an exit barrier and a cash-out machine, including existing parking facilities which at present have an exit barrier as well as new to construct parking facilities.

[0011] Further advantageously, the present method significantly simplifies parking, both from the perspective of users of the parking facility (i.e. drivers of vehicles) as well as from the perspective of facilitators of parking facilities such as the (local) government. With present parking methods, at some parking facilities after-payments are not possible (e.g. with "on the street" parking). With other parking methods after-payments are allowed (e.g. parking in a parking garage with exit barrier). Such a dual parking system with different payment systems is confusing for users of the parking facility, and also makes enforcement of parking regulations cumbersome for parking facilitators. With the present method, pay-while-parking via active parking rights as well as after-payments via retroactive parking rights becomes possible anywhere. Hence, with the present method the confusing dual system as present today is no longer needed. This is greatly convenient to users of parking facilities as the same options regarding payment are available anywhere. This is also greatly convenient for facilitators of parking facilities, as enforcement can be effected in the same way for all parking facilities.

[0012] In the context of the present disclosure, the wording "exit barrier" refers to any kind of exit barrier imaginable, both physical and non-physical barriers, presently-known solutions as well as future solutions. For example, a camera directed at an exit lane of a parking facility and configured to detect a unique identifier, such as a license plate, of the exiting vehicles is regarded an exit barrier. For example, a gate or other physical barrier than can prevent vehicles from leaving the parking facility is regarded an exit barrier. For example, a reader configured to read a (unique) RFID chip or other near-field communication technology associated with a vehicle is regarded an exit barrier.

[0013] Within the context of the present disclosure, vehicles parked at the parking facility are identified by a unique identifier thereof. Hence, the words "unique identifier" and "vehicle" will be used interchangeably throughout the present documents, the two words being inextricably linked to each other.

[0014] According to the present method, a database is used that comprises active parking rights as well as retro-active parking rights obtained via an after-payment

method.

[0015] Within the context of the present disclosure, an "active parking right" refers to a parking right that is obtained while parking or before parking. For example, if a parking subscription is obtained for a vehicle identifier, this identifier has an active parking right: the vehicle can be present in the parking facility at any time the subscription is valid, without the need for an additional payment. As a further example, when an occupant of the vehicle registers the start of the parking duration via a mobile payment method, the mobile payment method registering the parking duration from the start thereof, an active parking right is also present. The vehicle is paid for while being parked. Examples of mobile parking methods are yellowbrick, parkline, and other mobile payment methods (present methods or future methods). With such mobile parking methods one effectively registers, via the mobile payment method, the start of the parking action and the end of the parking action, and one pays for the parking duration.

[0016] Within the context of the present disclosure, a "retro-active" parking right refers to a parking right that is obtained only at the end of the parking duration, e.g. by paying at a payment terminal. For such payment methods, when the vehicle is parked there is no right yet, the right is only obtained at the end of the parking duration, before the vehicle leaves the parking facility. Thus, the parking right is obtained retro-actively with such a payment.

[0017] For example, the database may register the time of arrival of each registered vehicle / unique identifier. This time of arrival may e.g. be obtained from a camera aimed at the entrance of the parking facility. In particular, the camera may be a so-called Automatic Number Plate Recognition (ANPR) camera.

[0018] According to the present invention, a first step of the detection method is the identification of one or more vehicles present at the parking facility by retrieving unique identifiers of the one or more vehicles. This typically involves entering the parking facility, going around and identifying a unique identifier (such as a license plate) of each and every vehicle present. This step, called the first enforcement action in shorthand notation, serves as a baseline measurement and identifies a set of vehicles present at the parking facility. For example, the first enforcement action may comprise a human action of going into the parking facility and registering every vehicle. In another example, a robotic device may enter the parking facility to register every vehicle.

[0019] Optionally, in doing so, the vehicles registered as present in the parking facility may be compared to the vehicles registered at the entrance by the camera. Any vehicle not present but registered at the entrance and unknown in the parking rights database may be in violation of the parking regulations.

[0020] As the objective of the invention is to detect those vehicles that have parked at the facility but that have not obtained a parking right, all vehicles that have

an active right are of no interest. Therefore, in a second method step the database comprising such active rights is queried, for each of the identifiers in the set retrieved in the first enforcement action, to retrieve a subset of the identifiers. The query will result in two subsets: one subset containing the identifiers for which an active parking right is present and one subset containing the identifiers for which no active parking right is present. For the purpose of the present invention, it is the latter group of identifiers that is of interest. These identifiers may not be present in that database at all, or these identifiers may be known in the database, but without them presently having an active parking right.

[0021] Those vehicle of the subset without an active parking right can still obtain a retro-active parking right by performing a payment for the parking duration before leaving the parking facility. Therefore, the database may e.g. be queried at certain instances (e.g. once every half hour, once every hour, once every two hours, or less often or more frequent). Once a retro-active parking right is found for an identifier, the identifier may be removed from the subset. However, this intermediate step is not essential and may be omitted.

[0022] In accordance with the present invention, such a retro-active parking right may e.g. be obtained from cash-out machines associated with the parking facility. The cash-out machines allow an after-payment, e.g. based on the parking duration. The parking duration may be obtained from the difference between the present time, i.e. the time of departure, and the time of arrival as logged by the camera, in particular the ANPR camera, associated with the entrance. A particular example of such a cash-out machine is known in the art as a "pay and display device". A further alternative name for a cash-out machine includes "pay terminal", although other options are also in existence.

[0023] As explained in the above, in many present-day parking facilities it is not mandatory to obtain an active parking right, but it is also possible to obtain a retroactive parking right. This solution can still be offered to customers with the presented method, while mitigating the need for an exit barrier.

[0024] Assuming one is allowed to remain parked in the parking facility for an indefinite amount of time, the vehicles that do not have an active parking right after the first enforcement action are in violation of the parking regulations only when they have left the parking facility without having obtained a retro-active parking right. Therefore, according to the present invention a second enforcement action is carried out, at a later instance, to retrieve those vehicles of the subset that are absent from the parking facility. These vehicles are referred to as the subsubset: the vehicles present during the first enforcement action without an active parking right and absent from the parking facility during the second enforcement action. The vehicles still present are of minor interest, as they can still obtain a retro-active parking right upon exiting the parking facility. The vehicles that have left the

facility in the second enforcement action must have obtained a retro-active parking right to not be in violation. Like the first enforcement action, the second enforcement action involves going onto the parking facility and registering every vehicle present, either manually or with a robotic device. Especially in the second enforcement step it is of crucial importance that every vehicle present is identified, as otherwise a "false positive result" might be obtained: a vehicle which according to the method is absent while in real life it is still present.

[0025] Of course, the second enforcement action can simultaneously serve as the first enforcement action for vehicles not present during the first enforcement action but present during the second enforcement action.

[0026] After having registered that a certain identifier falls in the subsubset, the database is queried one final time. If a retroactive parking right is found, the identifier has been paid for and there is no absence of a parking right. If no retroactive parking right is found, the identifier is in violation of the parking regulations. Only when that final check is made the vehicle associated with the identifier can be confirmed as being in violation and can be marked.

[0027] Preferably also the identifiers associated with the vehicles of the subset, i.e. those not having an active parking right during the first enforcement action, are queried in the database at some point in time to confirm that a parking right is obtained. This can for example be done after the second enforcement action. If the entry time is logged in the database as well, and if the entry time at the second enforcement action for a certain identifier differs from the entry time at the first enforcement action, and if no retro-active parking right is found, the vehicle has left the parking facility after the first enforcement action and is present again at the second enforcement action without having obtained a parking right for the first parking action. Also such vehicles are in violation of parking regulations.

[0028] A second aspect of the present invention relates to a method for detecting absence of a parking right for vehicles parked at a parking facility,

the parking facility comprising an entrance, an exit and a cash-out machine; a camera being associated with the entrance, the exit without an exit barrier and the cash-out machine for obtaining a parking right near the end of a parking action, based on an entrance logged by the camera;

the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method, the method comprising the steps of:

- 1) in a first enforcement action: identifying one or more vehicles present at the parking facility by retrieving unique identifiers of one or more vehicles;
- 2) in a second enforcement action: identifying

one or more vehicles present at the parking facility by retrieving unique identifiers of one or more vehicles, the second enforcement action performed at a later instance than the first enforcement action;

3) retrieving a subset of vehicles, the subset comprising those vehicles present at the parking facility during the first enforcement action and absent during the second enforcement action;

4) for each identifier of the subset, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles of the subset that did not have an active parking right during the first enforcement action and that have not obtained a retro-active parking right in between performing the first and the second enforcement action;

5) marking the group of vehicles retrieved in step 4).

[0029] The method according to the second aspect of the present invention essentially comprises the same steps as the method according to the first aspect, but in a different order. As the steps are essentially the same but carried out in a different order, the inventive concept and the advantages obtained are the same for both the first and the second aspect of the invention, but the definition of the initial subset is different. Whereas according to the method of the first aspect the subset is defined as the group of vehicles that does not have an active parking right during the first enforcement action, the subset according to the second aspect of the invention is defined as the group of vehicles that has left the parking facility in the second enforcement action compared to the first enforcement action.

[0030] An advantage of the method according to the first aspect when compared to the method according to the second aspect is that the amount of data sent to and from the database may be lower, which may lead to lower operating costs.

[0031] A third aspect of the present invention relates to a method for detecting absence of a parking right for vehicles parked at a parking facility,

the parking facility comprising an entrance, an exit and a cash-out machine; a camera being associated with the entrance, the exit without an exit barrier and the cash-out machine for obtaining a parking right near the end of a parking action, based on an entrance logged by the camera;

the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method, the method comprising the step of:

1) in an enforcement action: identifying one or more vehicles present at the parking facility by retrieving unique identifiers of one or more ve-

hicles;

2) for each of the identifiers, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles that do not have an active parking right for parking at the parking facility;

3) for each of the identifiers in the subset, querying the database for a second time, at a later instance, to retrieve those vehicles of the subset that have not obtained a retro-active parking right in between the first and the second database query;

4) marking the group of vehicles retrieved in step 3).

[0032] Whereas in the methods according to the first and the second aspect it is assumed that a vehicle may be parked at the parking facility for an infinite amount of time, such that a second enforcement action is needed to detect a violation of the parking regulations, when the maximum duration is limited, such a second enforcement action may not be needed. When during the first enforcement action a certain vehicle is detected, that vehicle not having an active parking right, and that vehicle not having obtained a retro-active parking right at a later instance, the later instance equalling at least the maximum parking duration allowed and/or the later instance equalling a time at which vehicles are not allowed to be at the parking facility, the vehicle is in violation of parking regulations. Whereas the method according to the third aspect does not involve a check to determine whether a vehicle is still present at the later instance, this is irrelevant when there is a maximum parking duration and/or a closing time of the parking facility, and when the second database query is performed after said maximum parking duration and/or after the closing time of the parking facility. The vehicle may not have obtained a retroactive parking right as the vehicle is still on the parking facility, but this is not allowed in the scenario that there is a maximum parking duration and/or a closing time and the vehicle is in violation of the parking regulations after the maximum parking duration and/or after closing hours. When the vehicle has left the parking facility without having obtained a retroactive parking right, the vehicle is also in violation of the parking regulations, so also in that scenario the vehicle can be marked. A second enforcement action is not needed in any case.

[0033] With regards to the third aspect of the present invention, it is noted that the second and the third step may alternatively be carried out simultaneously, at the later instance.

[0034] Preferably the database is maintained and updated regularly. For instance, after a certain period of time, e.g. one year, items may be removed from the database. For instance, a previous database entry associated to a unique identifier may be removed from the database when the unique identifier enters the parking facility.

[0035] In an embodiment of the first, second and/or third aspect of the present invention, in between the first database query and the second database query the database is updated with a list of identifiers for which an after-payment has been made and/or with a list of retroactive parking rights obtained by identifiers already known to the database. This will make recognition of a retroactive parking right after the first enforcement action possible. Of course, the database can be updated at any time, e.g. at regular intervals, such as constantly, every 15 minutes, every half hour, every few hours, or once a day. Alternatively, the database can be update only upon request, e.g. before performing a new query.

[0036] Preferably the database is, in addition or alternatively, regularly updated in the sense that items are removed from the database. For example, when a unique identifier is present in the database, and an update is received that the unique identifier has left the parking facility (after having obtained an active or retroactive parking right), the identifier may be removed from the database. As a further example, if entry of the parking facility by an identifier is registered, an old database item related to that identifier may be removed / overwritten in the database. When removing or overwriting an item, before the old item is removed, a check may be performed. If a parking right is not found for the old database item, and it is registered that the identifier enters the parking facility again, the previous stay was without parking right and the identifier as well as the vehicle associated with it should be marked.

[0037] In an embodiment of the first aspect of the present invention, the database is queried before the second enforcement action is carried out, to retrieve those vehicles of the subset that have obtained a retro-active parking right and remove them from the relevant subset. This will reduce the amount of data handling and make the method more efficient in e.g. terms of computing efficiency.

[0038] In an embodiment of the first, second and/or third aspect of the present invention, the later instance at which the second enforcement action is carried out or at which the second database query is performed is in between 6 hours and 72 hours later, e.g. in between 12 hours and 48 hours later, e.g. about 24 hours later. A much more frequent database query and/or enforcement interval of e.g. every half hour, every hour, every 2 hours or every 3 or 4 hours would however also be possible.

[0039] In an embodiment of the first, second and/or third aspect of the present invention the later instance is after a closing time of the parking facility, e.g. anytime in between 23:00 hrs and 05:00 hrs. It is noted that not all parking facilities have a closing time, so this embodiment is only applicable for those parking facilities with a closing time, i.e. a time after which being present at the parking facility is not allowed.

[0040] For example, in a method according to the first aspect an enforcement action may be performed after closing hours to determine which vehicles are in the park-

ing facility at a time on which this is not allowed. At the same time, an enforcement action at this instance will catch vehicles having left the parking facility without having obtained a parking right but present during a possible third enforcement action (e.g. the next day) and which might go by undetected otherwise.

[0041] For example, in a method according to the second aspect, one assumes that every vehicle detected during the first enforcement action is absent during the second enforcement action if the second enforcement action is carried out after closing hours.

[0042] For example, in a method according to the third aspect, as explained in the above, one is in violation when at the second instance no parking right is found, irrespective of whether one is present or has left the parking facility.

[0043] In an embodiment of the first, second and/or third aspect of the present invention the active parking rights in the database are obtained from parking facility presubscription information and/or mobile parking providers such as Park-Line, Yellowbrick, Parkmobile, etc. Preferably all providers and all presubscription information is collected to make the database as complete as possible. The more complete the database, the less "false positive" marks are made, false positive marks being defined as marks of identifiers detected as having parked without a parking right while in reality a parking right exists. Therefore, it is important to not only cooperate with all present mobile parking providers to obtain their active parking rights, but also any future mobile parking providers (which can obviously not be mentioned by name now). In the Netherlands, such information may be extracted from the "Nationale ParkeerRechten Database".

[0044] In an embodiment of the first, second and/or third aspect of the present invention the unique vehicle identifier includes the vehicle license plate. However, not all vehicles have license plates. For example some mopeds only have an insurance registration unique to them, so preferably also such registrations can be registered. However, any other unique identifier may also be used as an alternative to a license plate and/or in addition to a license plate.

[0045] In an embodiment of the first, second and/or third aspect of the present invention the first and/or the second enforcement action is carried out via a handheld scanning and/or photographing device or via a scan car. These are just two of many different options to register the vehicles present at the parking facility. Just about anything works, as long as the unique identifiers of the vehicles can be registered, manually or with a robotic device.

[0046] In an embodiment of the first, second and/or third aspect of the present invention, after the marking step, information about each marked vehicle, including proof of presence during the first enforcement action and proof of absence of a parking right based on readouts of the database during the first and/or the second database

query is sent to a law enforcement agency. The law enforcement agency may then validate the received data and e.g. write out a fine based on the unique identifier for violation of the parking regulations.

DESCRIPTION OF THE FIGURE

[0047] The different aspects and embodiments of the present invention will now be elucidated further with reference to the attached figure. In this figure, the best working mode of the present inventive concept is schematically shown. It is noted that the figure is for illustrative purposes only; the scope of the present invention is as defined in the claims.

[0048] Before explaining the detection process in some detail based on steps A) - I), first the normal parking and payment process is described.

[0049] At 1), a vehicle enters a parking facility. At the entrance of the parking facility a camera registers a unique identifier, e.g. a license plate, of the vehicle entering the parking facility. As an alternative, or in addition, to registering the license plate of the vehicle, the driver of the vehicle may be forced to withdraw a (unique) ticket upon entering the parking facility. If this method of registration is chosen, the ticket is associated with a time of arrival. There may be a physical barrier at the entrance of the parking facility, but this is not required.

[0050] When a camera is used to register entrance of a vehicle in the parking facility, this entrance is stored in a local database at 2), e.g. along with a time of arrival, as a new database item. The driver of the vehicle parks the vehicle in the parking facility, and leaves the parking facility.

[0051] After some time, the driver of the vehicle returns to the parking facility and has to pay a certain amount of money, depending on the duration of the stay in the facility. When the camera has registered the license plate, the driver (or another person) enters his or her license plate at the cash-out machine, illustrated at 3). The cash-out machine communicates with the local database to obtain a parking duration based on the current time and the time of arrival and from that calculations the amount of money due at 4). Once the amount due is paid at the cash-out machine, an after-payment has made and a retroactive parking right has been obtained by the driver of the vehicle. He or she is able to leave the parking garage without being in violation of the parking regulations. The retroactive parking right obtained for the unique identifier is registered in a database at 5).

[0052] Instead of entering the license plate number, when a ticket is drawn upon entering the parking facility, the ticket may be fed to the cash-out machine and the amount of money due is calculated from the ticket. Also in this case a retroactive parking right is obtained, which is registered in the database at 5).

[0053] Besides paying retroactively, at the end of the stay in the parking facility, it is also possible to obtain an active parking right. This is illustrated at 6). Obtaining an

active parking right is e.g. possible for vehicles having a subscription registered in the database. Also vehicles that are paid for via a mobile parking application such as parking application PA1, PA2 and PA3 have active parking rights. Also such active payments are registered in the database.

[0054] So, at any one time, vehicles for which an active payment is ongoing may be present at the parking facility alongside vehicles for which no active payment is ongoing but for which may be paid retroactively.

[0055] Turning now to the enforcement part of the parking process, reference is made to steps A) - I). To determine the absence of a parking right, a first enforcement action EA1 is performed by identifying all vehicles present at the parking facility. This is done by retrieving the license plates of the vehicles. From this, a number of license plates, unique identifier 1 - unique identifier 11, is obtained, as illustrated in the first column of the table at C). In the example, eleven vehicles are present in the parking garage, and an equal number of unique license plates is retrieved.

[0056] For each of these license plates, a query in the database is performed to determine whether an active parking right is known in the database. When an active parking right is found, in the example for unique identifiers 1, 4 and 10, recognizable by the indication "Y", it is detected that there is a valid parking right and the license plate is no longer of interest for the purpose of detecting the absence of a parking right. The other license plates are flagged as being present at the parking facility without an active parking right. These license plates form a subset of the set of vehicles originally identified. As explained in the above, being present at the parking facility is not a violation per se as a retroactive parking right may still be obtained by making an after-payment before leaving the parking facility.

[0057] At EA2, step 2), a second enforcement action is carried out after some time. Again all vehicles present at the parking facility will in reality be identified, the second enforcement action being the first enforcement action for those vehicles that were not yet present during the first enforcement action but that are present now. However, for the purpose of explaining the present invention, we will focus on the originally identified subset. Of the remaining eight vehicles, unique identifier 6 is the only unique identifier that is absent during the second enforcement action compared to the first enforcement action. This vehicle forms the subset of vehicles that were present during the first enforcement action without an active payment right and that are absent during the second enforcement action. So, for this vehicle a database query in an updated version of the database is performed at F).

[0058] From the database query, it follows that no retroactive payment is found for unique identifier 7, so this vehicle is in violation of the parking regulations and is marked, at I).

[0059] The remaining seven unique identifiers of the

subset, numbers 2, 3, 5, 6, 8, 9, 11, are still present in the parking facility and remain in the subset. During a third enforcement action, only two are still identified as present in the parking facility: unique identifiers 6 and 9. The others are now absent: unique identifiers 2, 3, 5, 8, and 11. These unique identifiers form the new subset of vehicles, for which another query in the database is carried out at step H). Of the vehicles in the subset, a retroactive parking right is found for four thereof: unique identifiers 2, 5, 8 and 11. These vehicles have paid via an after-payment method and will not be marked. The remaining vehicle, unique identifier 3, is now absent without a parking right being found, so this license plate is marked for being in violation of the parking regulations.

[0060] The vehicles that are still present in the parking facility at the third enforcement action remain in the subset and will be evaluated during a fourth enforcement action.

CLAUSES

[0061]

1. A method for detecting absence of a parking right for vehicles parked at a parking facility,

the parking facility without an exit barrier;
the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method,
the method comprising the steps of:

1) in a first enforcement action: identifying one or more vehicle present at the parking facility by retrieving unique identifiers of one or more vehicles;

2) for each of the identifiers, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles that do not have an active parking right for parking at the parking facility;

3) in a second enforcement action: identifying at least one vehicle of the subset of vehicles as absent from the parking facility to retrieve a subset of vehicles comprising those vehicles of the subset that are absent during the second enforcement action, the second enforcement action performed at a later instance than the first enforcement action;

4) for each of the identifiers in the subset, querying the database to retrieve those vehicles of the subset that have not obtained a retro-active parking right in between performing the first and the second enforcement action;

5) marking the group of vehicles retrieved

in step 4).

2. A method for detecting absence of a parking right for vehicles parked at a parking facility,

the parking facility without an exit barrier;
the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method,
the method comprising the steps of:

1) in a first enforcement action: identifying one or more vehicles present at the parking facility by retrieving unique identifiers of one or more vehicles;

2) in a second enforcement action: identifying one or more vehicles present at the parking facility by retrieving unique identifiers of one or more vehicles, the second enforcement action performed at a later instance than the first enforcement action;

3) retrieving a subset of vehicles, the subset comprising those vehicles present at the parking facility during the first enforcement action and absent during the second enforcement action;

4) for each identifier of the subset, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles of the subset that did not have an active parking right during the first enforcement action and that have not obtained a retro-active parking right in between performing the first and the second enforcement action;

5) marking the group of vehicles retrieved in step 4).

3. A method for detecting absence of a parking right for vehicles parked at a parking facility,

the parking facility without an exit barrier;
the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method,
the method comprising the step of:

1) in an enforcement action: identifying one or more vehicles present at the parking facility by retrieving unique identifiers of one or more vehicles;

2) for each of the identifiers, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles that do not have an active parking right for parking at the parking facility;

- 3) for each of the identifiers in the subset, querying the database for a second time, at a later instance, to retrieve those vehicles of the subset that have not obtained a retro-active parking right in between the first and the second database query; 5
- 4) marking the group of vehicles retrieved in step 3).
4. The method according to any one of the claims 1 - 3, wherein in between the first database query and the second database query the database is updated with a list of identifiers for which an after-payment has been made. 10
5. The method according to claim 1, wherein the database is queried before the second enforcement action is carried out, to retrieve those vehicles of the subset that already have obtained a retro-active parking right before the second enforcement action is carried out, and remove them from the subset to narrow the subset. 15
6. The method according to any one of the preceding claims, wherein the later instance is in between 6 hours and 72 hours later, e.g. in between 12 hours and 48 hours later, e.g. about 24 hours later. 25
7. The method according to any one of the preceding claims, wherein the later instance is after a closing time of the parking facility, e.g. anytime in between 23:00 hrs and 05:00 hrs. 30
8. The method according to any one of the preceding claims, wherein the active parking rights in the database are obtained from parking facility presubscription information and/or mobile parking providers such as Park-Line, Yellowbrick, Parkmobile, etc. 35
9. The method according to any one of the preceding claims, wherein the retro-active parking rights in the database are obtained from check-out machines associated with the parking facility, the check-out machines allowing an after-payment, e.g. based on the parking duration. 40
10. The method according to any one of the preceding claims, wherein the unique vehicle identifier includes the vehicle license plate. 45
11. The method according to any one of the preceding claims, wherein the first and/or the second enforcement action is carried out via a handheld scanning and/or photographing device or via a scan car. 50
12. The method according to any one of the preceding claims, wherein after the marking step, information about each marked vehicle, including proof of 55

presence during the first enforcement action and proof of absence of a parking right based on readouts of the database during the first and/or the second database query is sent to a law enforcement agency.

13. A system for detecting absence of a parking right for vehicles parked at a parking facility, the system comprising:

- an identification device for identifying the presence of vehicles at the parking facility during an enforcement action, the identification device configured to retrieve a unique identifier of one or more vehicles in the parking facility;
- a database comprising identifiers for which an active parking right is obtained and identifiers for which a retro-active parking right is obtained;
- a processor, communicatively coupled with the identification device to retrieve the identifiers retrieved during an enforcement action, the processor configured for querying the database for all or a subset of all said identifiers, and the processor configured for marking identifiers.

14. The system according to claim 13, wherein the parking facility does not contain an exit barrier such as a gate or a camera.

15. The system according to claim 13 or 14, wherein the parking facility does not contain an entry barrier such as a gate or a camera.

Claims

1. A method of detecting absence of a parking right for vehicles parked at a parking facility,

the parking facility comprising an entrance, an exit and a cash-out machine; a camera being associated with the entrance, the exit without an exit barrier and the cash-out machine for obtaining a retro-active parking right near the end of a parking action, based on an entrance logged by the camera

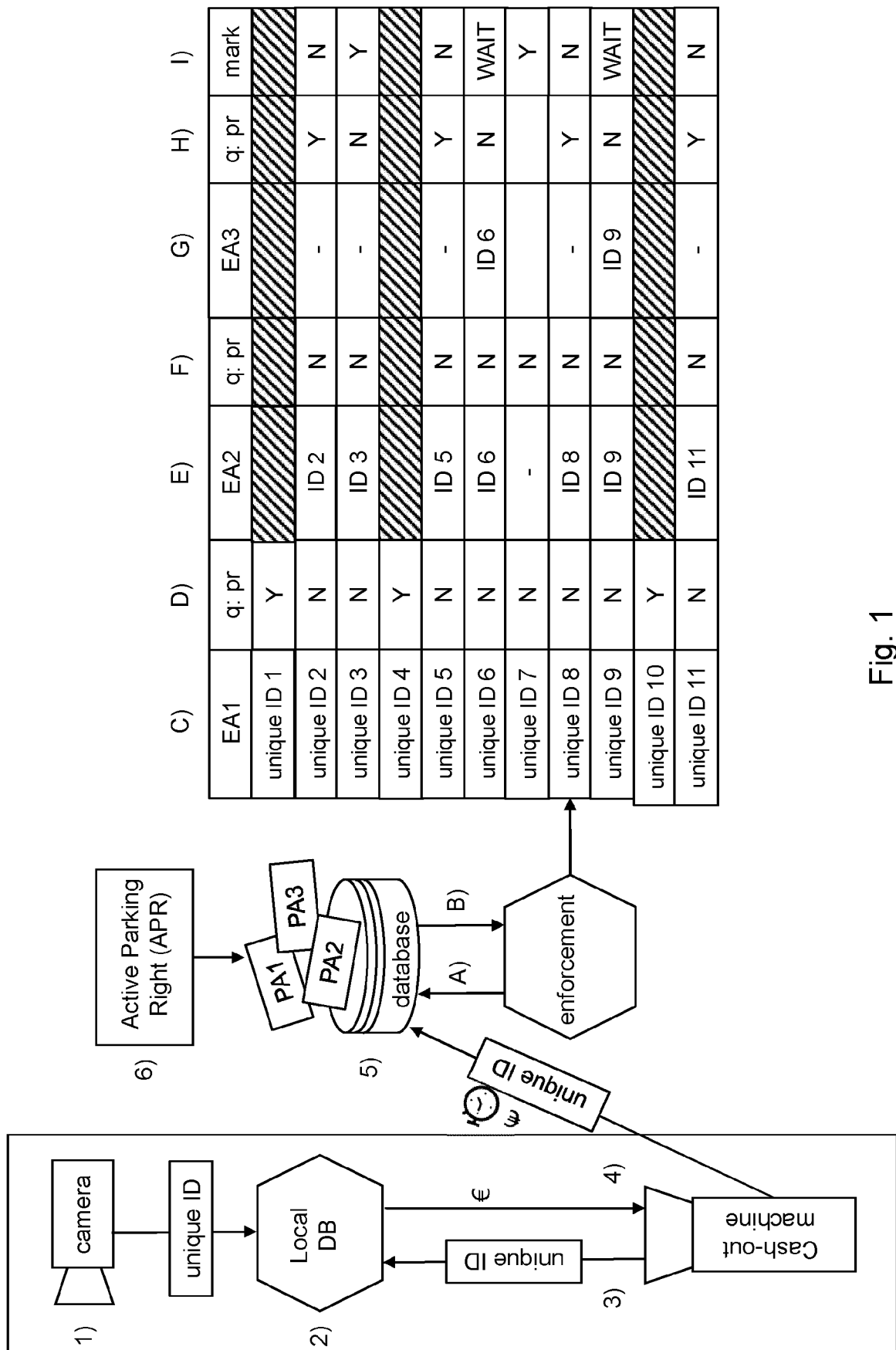
the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method,

the method comprising the steps of:

- 1) in a first enforcement action: identifying one or more vehicle present at the parking facility by retrieving unique identifiers of one or more vehicles;
- 2) for each of the identifiers, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles that

- do not have an active parking right for parking at the parking facility;
- 3) in a second enforcement action: identifying at least one vehicle of the subset of vehicles as absent from the parking facility to retrieve a subset of vehicles comprising those vehicles of the subset that are absent during the second enforcement action, the second enforcement action performed at a later instance than the first enforcement action;
- 4) for each of the identifiers in the subset, querying the database to retrieve those vehicles of the subset that have not obtained a retro-active parking right in between performing the first and the second enforcement action;
- 5) marking the group of vehicles retrieved in step 4).
2. A method for detecting absence of a parking right for vehicles parked at a parking facility,
- the parking facility comprising an entrance, an exit and a cash-out machine; a camera being associated with the entrance, the exit without an exit barrier and the cash-out machine for obtaining a retro-active parking right near the end of a parking action, based on an entrance logged by the camera;
- the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method,
- the method comprising the steps of:
- 1) in a first enforcement action: identifying one or more vehicles present at the parking facility by retrieving unique identifiers of one or more vehicles;
 - 2) in a second enforcement action: identifying one or more vehicles present at the parking facility by retrieving unique identifiers of one or more vehicles, the second enforcement action performed at a later instance than the first enforcement action;
 - 3) retrieving a subset of vehicles, the subset comprising those vehicles present at the parking facility during the first enforcement action and absent during the second enforcement action;
 - 4) for each identifier of the subset, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles of the subset that did not have an active parking right during the first enforcement action and that have not obtained a retro-active parking right in between performing the first and the second enforcement action;
 - 5) marking the group of vehicles retrieved in step 4).
- forming the first and the second enforcement action;
- 5) marking the group of vehicles retrieved in step 4).
3. A method for detecting absence of a parking right for vehicles parked at a parking facility,
- the parking facility comprising an entrance, an exit and a cash-out machine; a camera being associated with the entrance, the exit without an exit barrier and the cash-out machine for obtaining a retro-active parking right near the end of a parking action, based on an entrance logged by the camera;
- the method making use of a database comprising active parking rights as well as retro-active parking rights obtained via an after-payment method,
- the method comprising the step of:
- 1) in an enforcement action: identifying one or more vehicles present at the parking facility by retrieving unique identifiers of one or more vehicles;
 - 2) for each of the identifiers, querying the database to retrieve a subset of vehicles, the subset comprising those vehicles that do not have an active parking right for parking at the parking facility;
 - 3) for each of the identifiers in the subset, querying the database for a second time, at a later instance, to retrieve those vehicles of the subset that have not obtained a retro-active parking right in between the first and the second database query;
 - 4) marking the group of vehicles retrieved in step 3).
4. The method according to any one of the claims 1 - 3, wherein in between the first database query and the second database query the database is updated with a list of identifiers for which an after-payment has been made.
5. The method according to claim 1, wherein the database is queried before the second enforcement action is carried out, to retrieve those vehicles of the subset that already have obtained a retro-active parking right before the second enforcement action is carried out, and remove them from the subset to narrow the subset.
6. The method according to any one of the preceding claims, wherein the later instance is in between 6 hours and 72 hours later, e.g. in between 12 hours and 48 hours later, e.g. about 24 hours later.

7. The method according to any one of the preceding claims, wherein the later instance is after a closing time of the parking facility, e.g. anytime in between 23:00 hrs and 05:00 hrs.
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8. The method according to any one of the preceding claims, wherein the active parking rights in the database are obtained from parking facility presubscription information and/or mobile parking providers such as Park-Line, Yellowbrick, Parkmobile, etc.
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9. The method according to any one of the preceding claims, wherein the unique vehicle identifier includes the vehicle license plate.
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10. The method according to any one of the preceding claims, wherein the first and/or the second enforcement action is carried out via a handheld scanning and/or photographing device or via a scan car.
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11. The method according to any one of the preceding claims, wherein after the marking step, information about each marked vehicle, including proof of presence during the first enforcement action and proof of absence of a parking right based on readouts of the database during the first and/or the second database query is sent to a law enforcement agency.
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EUROPEAN SEARCH REPORT

Application Number

EP 22 16 9680

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