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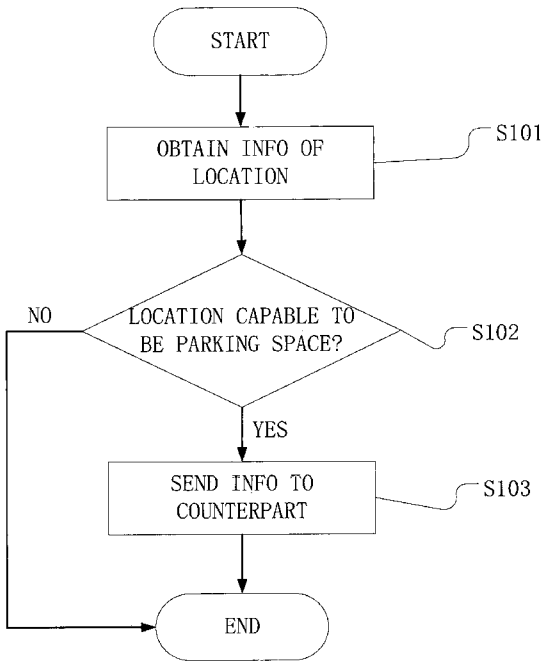



FIG. 2

(57) Abstract: The present disclosure discloses a system for processing information of a location which is able to be used for parking vehicle, including: a sensor unit, obtaining information of a location during a vehicle passing the location, by means of at least one laser scanner mounted on the vehicle; a processing unit, determining whether the location is able to be used for parking vehicles based on the information of the location; and a communication unit, sending the information of the location to a communication counterpart, if the location is able to be used for parking a vehicle. A corresponding method and a vehicle equipped with such system are also disclosed. According to the present disclosure, real time information of available parking spaces, regardless dedicated parking spaces or not, can be obtained and be used.

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# A SYSTEM AND A METHOD FOR PROCESSING INFORMATION OF PARKING LOCATIONS AND A VEHICLE EQUIPPED WITH SUCH SYSTEM

## DESCRIPTION

## TECHNICAL FIELD

The present disclosure relates to a system and a method for processing information and a vehicle equipped with such system.

## BACKGROUND

Nowadays, as the amount of vehicles increases, especially for metropolitans, it is not so easy to find a suitable parking space for drivers. Sometimes, especially for rush hours, the driver has to spend a lot of time to find an available parking space. Therefore, a need of providing real-time information of parking spaces is raised up.

In GB2421622 A, a system for identifying and utilizing free car park spaces is disclosed, wherein, ultrasonic sensors are used for detecting the car park spaces, and the information of detected car park spaces will be shared among a group of users who have paid for the information.

However, in this case, due to the ability of ultrasonic sensors, only dedicated parking spaces, that is, legal and nice parking spaces, can be detected. In fact, in most of the cities, there are lots of other spaces which can be used as parking spaces without violating any prohibition rules, although they are not dedicated parking spaces. For such spaces, they are difficult to be identified by traditional ultrasonic sensors.

## SUMMARY OF THE INVENTION

Therefore, in order to identifying all the locations which can be used as parking spaces, regardless dedicated parking spaces or not, the system, method and vehicle equipped with such system are proposed.

According to one aspect of the present disclosure, it is provided a system for processing information of a location which is able to be used for parking vehicle, including: a sensor unit, obtaining information of a location during a vehicle passing the location, by means of at least one laser scanner mounted on the vehicle; a processing unit, determining whether the location is able to be used for parking vehicles based on the information of the location; and a communication unit, sending the information of the location to a communication counterpart, if the location is able to be used for parking a vehicle.

For the sensor unit, the laser scanner may be designed to detect a scope of 0 - 15 meters. Multiple laser scanners may be mounted on at least one side of the vehicle. Besides, the sensor unit may obtain the information of the location also by means of another sensor mounted on another vehicle or an infrastructure. The information of the location can include at least one of the size and orientation of the location.

The processing unit may determines whether the location is able to be used for parking vehicles also based on prohibition information of the location provided by an existing database.

The communication unit may send the information of the location with a time stamp to the communication counterpart. The communication counterpart may be another vehicle or a server.

According to another aspect of the present disclosure, a method for processing information of a location which is able to be used for parking vehicles, including: obtaining information of a location during a vehicle passing the location, by means of at least one laser scanner mounted on the vehicle; determining whether the location is able to be used for parking vehicles based on the information of the location; and sending the information of the location to communication counterpart, if the location is able to be used for parking a vehicle.

According to a further aspect of the present disclosure, a vehicle equipped with a system for processing information of a location which is able to be used for parking vehicles, wherein the system includes: a sensor unit, obtaining information of a location during the vehicle passing the location, by means of at least one laser scanner mounted on the vehicle; a processing unit, determining whether the location is able to be used for parking vehicles based on the information of the location; and a communication unit, sending the information of the location to a communication counterpart, if the location is able to be used for parking vehicles.

By means of the system, method and vehicle described above, it is possible to identifying all the locations which can be used as parking spaces, regardless dedicated parking slots or not.

## BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the present disclosure will become apparent in the following description of the preferred embodiment with reference to the accompanying drawings, of which:

Fig. 1 shows a block view of the system according to an embodiment of the present disclosure; and

Fig. 2 shows the flows of the method according to an embodiment of the present disclosure.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig. 1, a system 10 for processing information of a location which is able to be used for parking vehicle is shown. The system 10 includes a sensor unit 101, a processing unit 102 and a sending unit 103.

When a vehicle V equipped with the system 10 passes a location A, the sensor unit 101 can obtain information of the location A, by means of at least one laser scanner mounted on the vehicle V. The system 10 can be designed to always run during the driving of the vehicle V, or only be activated in some cases, for example when not driving on high way, or manually activated by the driver of the vehicle V.

The laser scanner is preferred to have a detection scope of 0 - 15 meters, because within such a detection scope, usually a sufficient accuracy of detection can be obtained. However, other detection is also conceivable for those skilled in the art due to the design target. Although a single laser scanner mounted on one side of the vehicle V can be used, it is preferred to have multiple laser scanners mounted on at least one side of the vehicle. For example, the laser scanners can be mounted on the right side of a left-steering vehicle, while the laser scanners can also be mounted on the left side of a right-steering vehicle. Of course additional laser scanners can be mounted on the front and/or rear of the vehicle V, or laser scanners can be mounted on both sides of the vehicle V.For the example of driving on right side (left-steering vehicle), a potential parking space is usually on the right side of the vehicle V, while on the left side there is usually the opposite driving lane. By means of the laser scanners, it is possible to get a 3D model of the location A on right side of the vehicle V in case of using laser scanners mounted on the right side of the vehicle V, even a 3D model of a location A' on the left side of the vehicle V in case of using laser scanners mounted on both sides of the vehicle V.

It should be noted that, for those skilled in the art, other arrangement of the laser scanners can also be conceived to achieve the target of obtaining the necessary information of the location A.

In addition, other type of sensors, such as cameras and ultrasonic sensors, can also be used to provide more information of the current location A.

Compared to the using of laser scanners, if only ultrasonic sensors are used, only a rough result of whether there is an object in the detection scope of the ultrasonic sensor can be detected, rather than a 3D model. Besides, for ultrasonic sensors, there is always a speed limitation, and when the vehicle V is on a speed higher than the speed limitation, the detection result of ultrasonic sensors is not reliable any more.

Furthermore, the sensor unit 101 may obtain the information of the location not only by means of the sensors mounted on the vehicle V itself, but also sensors mounted on another vehicle or an infrastructure. For example, the sensors mounted on the vehicle V and on other vehicles close to the vehicle V as well as an infrastructure around the vehicle V can communicate with each other, and therefore form a network. From such a network, the sensor unit 101 can obtain more accurate information of the location A. All kinds of sensors can be used to forming such a network, for example, cameras for detecting traffic violations and cameras for other purpose in public area. By using of such a network, more information of the location A can be obtained.

The information of the location A obtained by the sensor unit 101 can include at least one of the size and orientation of the location A. In another word, based on the 3D model of the location A, at least one of the size and orientation of the available space in location A can be obtained.

Based on above information of the location A, the processing unit 102 can determine whether the location A is able to be used for parking vehicles. Please note that, the "vehicles" herein does not only mention to the vehicle V itself, but also could be any other vehicles. Basically, such determination needs to take many limitations into account, such as whether the size meets the requirement of lowest limitation for parking vehicles, whether the location is before the gate or entrance of a building or yard, and so on.

To perform such determination, an existing data base, such as a navigation database, can also be used. For example, based on whether there is any prohibition information of the location A provided by the navigation existing database, the determination of whether the location A is able to be used for parking vehicles can be made without the risk of breaking the prohibition rules.

If the location A is determined to be able to be used for parking vehicles, the communication unit 103 can send the information of the location A to a communication counterpart 20. The communication 20 counterpart could either be another vehicle or a server.

If the communication counterpart 20 is one or more other vehicles, all of these two vehicles could have their own system 10 and share the information of available parking space with each other, or only some of the vehicles have their own system 10 and the other vehicles only receive information of available parking spaces. The more vehicles equipped with the system 10 involved, the more information can be gathered and shared.

If the communication counterpart 20 is a server, multiple vehicles communicating with the server can form a network and the information of available parking spaces can be shared among the network. By means of such a network, more information can be gathered and shared, and even organized as a map of available parking spaces map.

To achieve a real-time database of available parking spaces, the communication unit 103 can also send a time stamp together with the information of the location A. Therefore, all the information of available parking space could have a fixed expiration period, or an expiration period determined by a special rule. For example, for the areas with busy traffic, the expiration period of available parking spaces may be shorter, while for the areas without busy traffic, the expiration period of available parking spaces may be longer.

For vehicles using such information of available parking spaces, they can download such information and display it to their driver or user. Besides, based on the size of the available parking spaces, a vehicle can automatically filter the available parking spaces based on the size of itself. Therefore, a too tight parking space will not be shown to the driver or user. In some cases, the orientation of the potential parking spaces can also be used for filtering, for example, according to the parking habit of the user. Some users prefer a vertical parking space, while others prefer a diagonal a parking space or a vertical parking space.

Preferably, an available parking space, either chosen by the driver or automatically selected based on distance to the vehicle or other rule, can be used as target location of the navigation system.

In Fig. 2, the flows of the method according to an embodiment of the present disclosure are shown.

At step S101, information of a location A is obtained during a vehicle V passing the location, by means of at least one laser scanner mounted on the vehicle V. Such step may be performed by the sensor unit 101 of the system 10 carried by the vehicle V, as described in Fig. 1. After the step S101, the process goes to the step S102.

At step S102, whether the location A is able to be used for parking vehicles is determined based on the information of the location A. Such step may be performed by the processing unit 102 of the system 10.

If the result of determination is YES, the process goes to the step S103. Otherwise, the process ends.

At step S103, the information of the location A is sent to a communication counterpart, and then the process ends. Such step may be performed by the communication unit 103 of the system 10.

Above is the method for processing the information of the location A. Since the vehicle V passes lots of different locations, such method repeats again and again for different locations passed by the vehicle V.

In another case, even for the same location A, the parking situation is changing from time to time, and thus the method described above can be continuously repeated for the same location.

Please be advised that the vehicle V equipped with the system 10 is not shown in the figures, but it is easy to be conceived by those skilled in the art.

Based on above descriptions, it is shown that by means of the system, method and vehicle according to the embodiments of the present disclosure, it is possible to identifying all the locations which can be used as parking spaces, regardless dedicated parking slots or not

While the present invention has been described in connection with what is considered the most practical and preferred embodiment, it is understood by those skilled in the art that this invention is not limited to the disclosed embodiment but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

Claims

1. A system for processing information of a location which is able to be used for parking vehicle, comprising:
   a sensor unit, obtaining information of a location during a vehicle passing the location, by means of at least one laser scanner mounted on the vehicle;
   a processing unit, determining whether the location is able to be used for parking vehicles based on the information of the location; and
   a communication unit, sending the information of the location to a communication counterpart, if the location is able to be used for parking a vehicle.
2. The system according to Claim 1, wherein the laser scanner is designed to detect a scope of 0 - 15 meters.
3. The system according to Claim 1 or 2, wherein multiple laser scanners are mounted on at least one side of the vehicle.
4. The system according to any one of Claims 1 to 3, wherein the sensor unit obtains the information of the location also by means of another sensor mounted on another vehicle or an infrastructure.
5. The system according to any one of Claims 1 to 4, wherein the information of the location comprises at least one of the size and orientation of the location.
6. The system according to any one of Claims 1 to 5, wherein the processing unit determines whether the location is able to be used for parking vehicles also based on prohibition information of the location provided by an existing database.
7. The system according to any one of Claims 1 to 6, wherein the communication unit sends the information of the location with a time stamp to the communication counterpart.
8. The system according to any one of Claims 1 to 7, wherein the communication counterpart is another vehicle or a server.
9. A method for processing information of a location which is able to be used for parking vehicles, comprising:
   obtaining information of a location during a vehicle passing the location, by means of at least one laser scanner mounted on the vehicle;
   determining whether the location is able to be used for parking vehicles based on the information of the location; and
   sending the information of the location to communication counterpart, if the location is able to be used for parking a vehicle.
10. A vehicle equipped with a system for processing information of a location which is able to be used for parking vehicles, wherein the system comprises:

a sensor unit, obtaining information of a location during the vehicle passing the location, by means of at least one laser scanner mounted on the vehicle;
a processing unit, determining whether the location is able to be used for parking vehicles based on the information of the location; and
a communication unit, sending the information of the location to a communication counterpart, if the location is able to be used for parking vehicles.

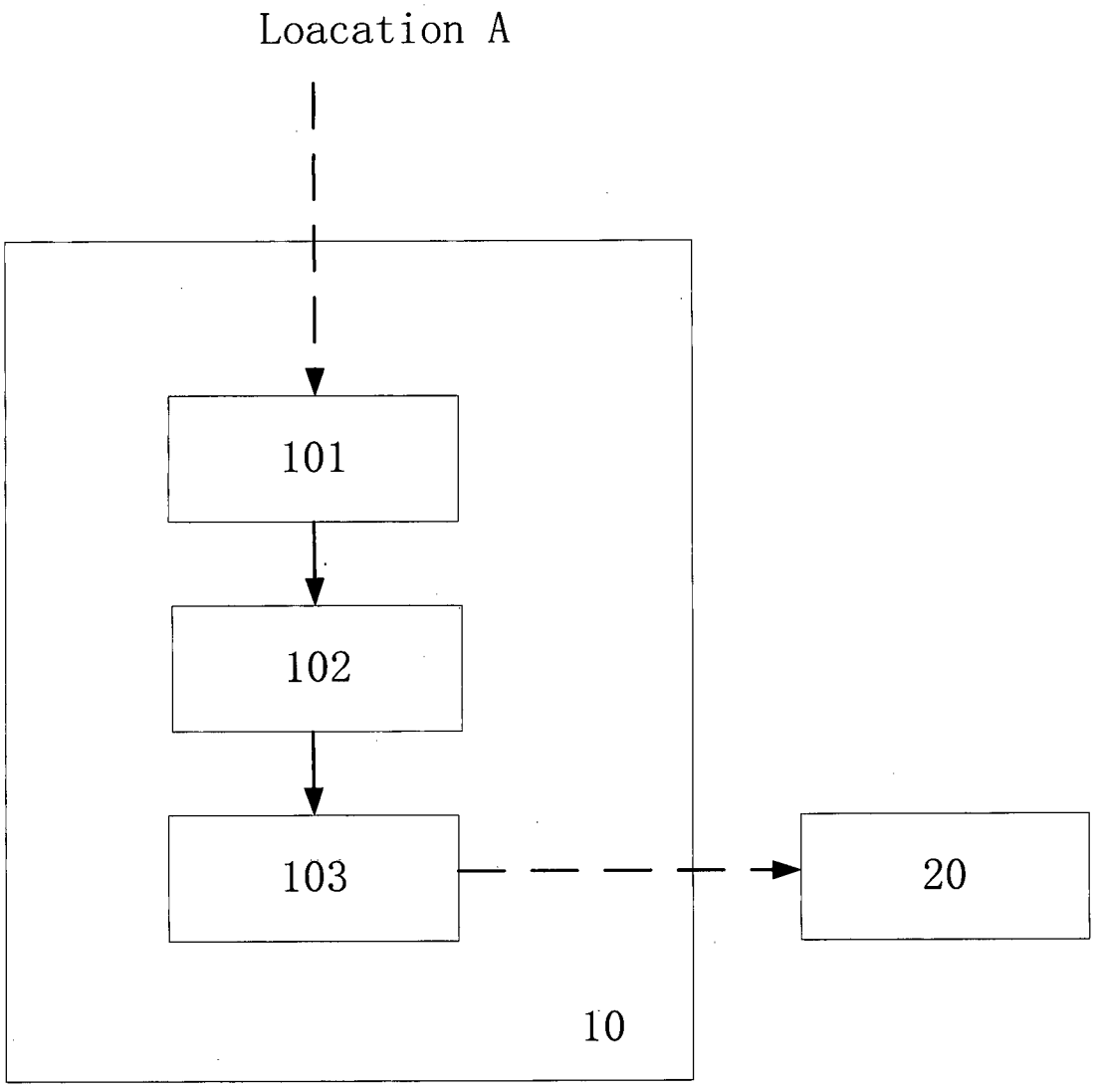



FIG. 1

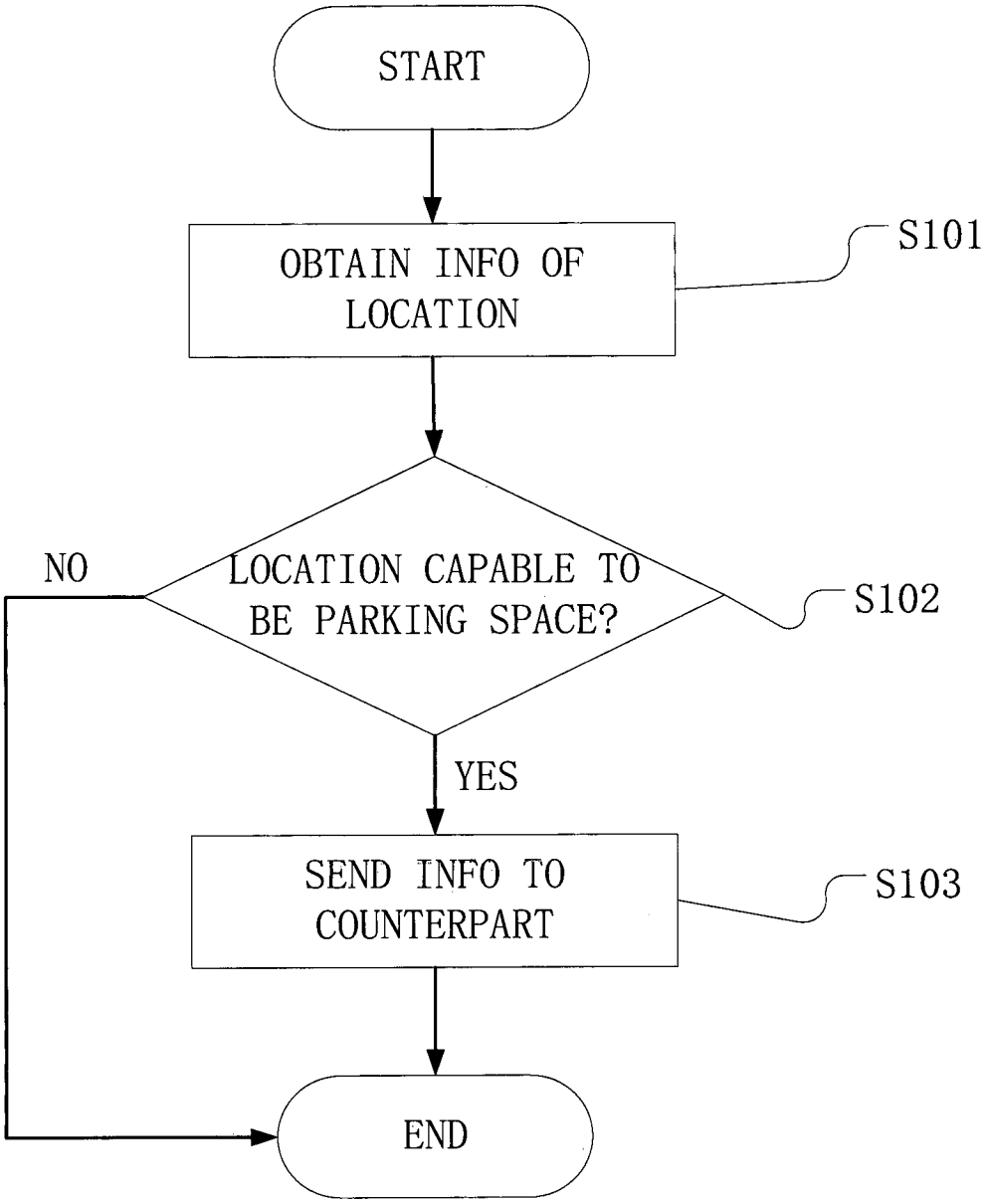

START
OBTAIN INFO OF LOCATION
S101
LOCATION CAPABLE TO BE PARKING SPACE?
S102
NO
YES
SEND INFO TO COUNTERPART
S103
END

FIG. 2

# INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/001029

A. CLASSIFICATION OF SUBJECT MATTER
INV. G08G1/14 G08G1/01 G01C21/36
ADD.

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 G01C

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 practicable, search terms used)
EPO-Internal, WPI Data

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

☒ See patent family annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 30 September 2016 | 07/10/2016 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Nanos, Alexander |

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