

TITLE

A DEVICE FOR AUTO-IDENTIFYING THE VEHICLES PARKING ILLEGALLY IN RESERVED PARKING LOTS

Throughout this specification, unless the context requires otherwise, the word "comprise" and variations such as "comprises", "comprising" and "comprised" are to be understood to imply the presence of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

Throughout this specification, unless the context requires otherwise, the word "include" and variations such as "includes", "including" and "included" are to be understood to imply the presence of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

FIELD OF THE INVENTION

The present invention relates to a device for auto-identifying vehicles parking illegally in reserved parking bays, so as to facilitate the parking enforcement process.

BACKGROUND OF THE INVENTION

The discussion of the background art, any reference to a document and any reference to information that is known, which is contained in this specification, is provided only for the purpose of facilitating an understanding of the background art to the present invention, and is not an acknowledgement or admission that any of that material forms part of the common general knowledge in any country as at the priority date of the application in relation to which this specification was filed.

Car parks are commonplace in areas where there are vehicles that require to be parked (for example, in cities and towns). Such car parks have designated parking lots (also sometimes referred to as parking bays or parking spaces) for parking individual vehicles. The parking lots are usually defined by lines painted on the ground to show the boundaries of each parking lot. Car parks can be small, with parking spaces for only a few vehicles, very large with spaces for hundreds or even thousands of vehicles, or any size in between.

To keep vehicle traffic and car parks in order, parking enforcement officers are employed to take appropriate action when they identify or determine that a vehicle is parked in a way that breaches the relevant parking codes or regulations, which is referred to herein as the vehicle being parked illegally. Such a vehicle is also referred to herein as an "illegally parked vehicle". The main procedural steps

performed in the enforcement action undertaken by a parking enforcement officer may be described as follows:

- I. check parked vehicles and identify or determine when a vehicle is parked in a way that breaches the relevant parking codes or regulations;
- II. input the vehicle identification (ID) of the illegally parked vehicle and the related parking offence/violence details in an enforcement device (normally a handheld terminal) to issue a parking offence notice (also called a parking violation ticket); usually, the vehicle license plate number is used as the vehicle ID since the vehicle license plate number uniquely identifies the vehicle;
- III. put the parking offence notice under the front windscreen wiper of the illegally parked vehicle.

In existing vehicle parking enforcement systems, the above three steps are all performed manually by the parking enforcement officer. The step which is often the most time consuming is checking and identifying or determining that a vehicle is parked illegally.

Some parking offences can be easily identified by visual checking (such as, for example, parking other than in a designated parking lot, parking beyond the boundaries of a parking lot thereby causing obstruction, parking without displaying the required ticket/coupon, etc.). However, other parking offences can be difficult to identify.

One example of a parking offence that can be difficult for a parking enforcement officer to identify or determine is illegal parking of vehicles in reserved parking lots. Only authorized vehicles are permitted to be parked in reserved parking lots. Reserved parking lots may include, for example, parking lots reserved for season parking, for handicap parking, for special events parking, etc.

By way of example, in order to determine if a vehicle that is parked in a season parking lot is parked illegally, the parking enforcement officer has to firstly confirm if there is a season parking label displayed inside the vehicle's front windscreen (if it not displayed, it is an offence), and then to verify the validity of the season parking label by visually checking the detailed information printed on the season parking label, such as the authorized vehicle ID, valid parking area (e.g. whether the season parking label is valid for the car park and/or parking lot in which the vehicle is parked) and whether the season parking label is for the valid period. In the case of electronic season parking labels being used, the parking enforcement officer can use a handheld terminal to readout, within a 10 cm distance from the electronic season parking label, the detailed information stored in the electronic season parking label.

Strictly speaking, parking enforcement officers should check all the vehicles parking in every reserved parking lot in a car park. However, for a residential car park with

many season parking lots, it becomes a very time consuming and tedious, even an impossible, task.

OBJECT OF THE INVENTION

The object of this invention is to provide a device to facilitate checking and determining when vehicles are parked illegally in parking lots.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention, there is provided a device for determining if a vehicle is illegally parked in a parking lot comprising at least

- a memory to store information pertaining to a list of authorized vehicles, including information to uniquely identify each authorized vehicle in the list and information pertaining to the associated parking lots that each authorised vehicle is authorised to occupy,

- a parking lot identifier to provide parking lot information pertaining to a parking lot,

- a vehicle ID reader to capture the vehicle ID of a vehicle that is parked in a parking lot,

- an equipment interface to receive at least the parking lot information from the parking lot identifier and the vehicle ID from the vehicle ID reader for the vehicle parking in the parking lot, and

- a microprocessor to receive the parking lot information and the vehicle ID from the equipment interface and to compare the received parking lot information and the vehicle ID vehicle with the information data stored in the memory, and determine if the vehicle is parked illegally in the parking lot based on the comparison between the received parking lot information and the vehicle ID vehicle and the information data stored in the memory if the vehicle is parked in a parking lot for which it is not authorised to occupy.

Preferably, the memory is coupled to the microprocessor.

Preferably, the information pertaining to the list of the authorized vehicles includes the following data for each authorized vehicle in the list of the authorized vehicles: license plate number, vehicle's electronic ID (such as the that coded in the vehicle IU) if there is one, authorized parking lot type(s), parking location (car parks, parking lots), valid parking periods and time zones, etc.

Preferably, the vehicle ID reader may be one or both of the following: an OCR camera for capturing vehicle license plate information, a RF antenna for reading the in-vehicle electronic label/unit number (IU).

Preferably, the parking lot identifier provides parking lot information to the equipment interface for auto-identifying process control. The parking lot information may be parking lot type (for example, reserved parking lot, handicap parking lot and normal parking lot), parking lot number, etc. The parking lot identifier may be one or more of the following: a manually operated switch, an OCR camera to identify the parking lot boundary, the parking lot color or the parking lot number, or an RF antenna to read an RF tag associated with the parking lot.

Preferably, the equipment interface is coupled to the microprocessor and comprises one or more of the following: serial communication ports, USB port, LAN port, and digital input/output ports.

Preferably, the microprocessor is coupled to the equipment interface, to the memory, and to the clock. For every reserved parking lot, the microprocessor firstly receives the actual parking lot information and the vehicle ID; secondly, compares the received actual data with the data stored in the memory to determine if a vehicle is illegally parked in a parking lot; additionally, to indicate equipment and operation status; to issue an alarm when it is necessary to do so; and, to record the result of the illegal parking determination with a time stamp.

Preferably, the device also records the vehicles that are parked legally such that the device can also be used to find out the total number of vehicles that have been checked in a selected period using the device.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of an embodiment of a device for determining if a vehicle is illegally parked in a parking lot;

Figure 2 is a further schematic diagram of the embodiment of the device shown in Figure 1, showing additional components (excluding the motorcycle and the handheld terminal) that may be used for an application system for the enforcement of vehicles parking illegally in parking lots;

Figure 3 is an embodiment of the main operation screen of the device shown in Figures 1 and 2; and

Figure 4 is an embodiment of the Auto-Checking operation screen of the device shown in Figures 1 and 2.

Description of an Embodiment of the Invention

Since all the motorized vehicles registered in Singapore are equipped with an In-vehicle Unit (IU) that is coded to uniquely identify the vehicle, the device (1) of the

present may use the information coded into a vehicle's IU to identify the vehicle. However, the vehicle may be identified by the device (1) in other ways. The application system provided by the device (1) of the present invention provides a motorized enforcement system that uses a motorcycle, the device (1) and other necessary external electronic devices, including an enforcement device in the form of a handheld terminal, which may be of a type currently used by parking enforcement officers.

In Figures 1 and 2, there is shown a device (1) comprising a memory, which may be provided as a SSD (Solid State Drive) (3) to store information pertaining to a list of authorized vehicles, a vehicle ID reader which may be provided as an RF antenna (6), a parking lot identifier which may be provided as a manually operated parking lot type switch (7), equipment interface (5) to receive information from the vehicle ID reader and the parking lot type switch (7), and a microprocessor (2) to receive information from the equipment interface (5) to determine if a vehicle is parked illegally in the parking lot it occupies.

The information pertaining to a list of authorized vehicles that is stored in the SSD memory (3) includes information to uniquely identify each authorized vehicle in the list and information pertaining to the associated parking lots that each authorised vehicle is authorised to occupy. The information data to uniquely identify each authorized vehicle in the list of authorized vehicles may include the vehicle IU number and license plate number (as the vehicle IDs). The information pertaining to the associated parking lots that each authorised vehicle is authorised to occupy may include car park code(s) for the relevant parking locations and car parks, the types of parking lots in which the vehicle is authorised to be parked (such as season parking lot type), and the valid parking periods and time zones for parking the vehicle.

The parking lot type switch (7) provides parking lot information for auto-identifying process control. The parking lot information may be lot type (for example, reserved parking lot, handicap parking lot, and normal parking lot, etc.), parking lot number, etc. The manually operated parking lot type switch (7) is used by the operator of the device (1) (usually, the operator will be a parking enforcement officer) to input the parking lot type information into the device (1).

The equipment interface (5) is coupled to the microprocessor (2) and comprises a serial communication port coupled to the RF Antenna (6), a USB port linked to a wireless modem (10) for data import and export, a digital input port connected to the parking lot type switch (7), a digital output port linked to an alarm (11) and a few LED indicators (12), and a touch screen monitor interface (9). The equipment interface (5) is used for the following purposes: to import the authorized vehicle list and other data to be stored in the SSD memory (3) before performing an auto-identifying procedure; to receive actual parking lot information from parking lot type switch (7), the vehicle ID from the vehicle ID reader (6), and other operational instructions during the auto-identifying procedure; for driving the LED indicators (12), alarm light and sound of

the alarm (11), during the auto-identifying procedure; and for exporting results after completion of the auto-identifying procedure.

The microprocessor (2) receives the parking lot information and the vehicle ID from the equipment interface (5) and compares the received parking lot information and the received vehicle ID with the information data stored in the SSD memory (3), and then determines if the vehicle is parked illegally in the parking lot based on the comparison between the received parking lot information and the received vehicle ID and the information data stored in the SSD memory (3) based on whether the vehicle is parked in a parking lot which it is not authorised to occupy.

The device (1) further comprises a real time clock (4) to produce time stamps for events and records pertaining to vehicles parked illegally and a power supply unit, which may be provided as a rechargeable battery (8), to provide power to all components of the device (1). However, the power for the device (1) may alternatively be provided from other sources, for example, from a vehicle (such as a motor cycle) on which the device (1) is carried or mounted.

The device (1) further comprises a wireless modem (10) for the device (1) to communicate with a server and/or host computer. The wireless modem (10) is used for importing an authorized vehicles list from a data server (not shown), which is not part of the device (1) of the present invention, as well as for exporting the results of illegal parking identification to a host computer (not shown), which is not part of the device (1) of the present invention. The wireless modem (10) can also be used for communication with the handheld enforcement terminal. The authorized vehicles list, imported by the wireless modem (10), is stored in the SSD memory (3).

The device (1) further comprises indicators, such as LED indicators (12). The LED indicators (12) are used for showing equipment and operation status of the device (1) to the operator (that is, the parking enforcement officer).

The device (1) further comprises alarm (11), referred to as a "Beacon" in Figure 2. The alarm (11) is used to alert the parking enforcement officer when the device (1) determines that a vehicle is parked illegally, (that is, when it is parked in a parking lot that it is not authorised to occupy), or when there is an operation or equipment problem, such as, for example that the vehicle IU number cannot be read, the battery is low, etc.

The device (1) further comprises a touch screen monitor (9). The touch screen monitor (9) is used as the man-machine interface. The parking enforcement officer may input operation instructions into the device (1) using the touch screen monitor (9). The touch screen monitor (9) may also display information, such as the operation status of the device (1) and results for viewing by the parking enforcement officer.

The manner of use and operation of the device (1) of the present invention will now be described.

The application program carried out by the device (1) has main operation tasks as set out below. The operation instructions, or commands, to carry out the operation tasks are input into the device (1) by the parking enforcement officer using buttons on the touch screen monitor (9). These buttons are shown in Figure 3. The buttons used to carry out the operation tasks are identified below by use of square brackets ([]) containing the name of the respective button shown in Figure 3.

- a. Download the list of the authorized vehicles [Download Season]
- b. Selection of the car park and location to be checked; [Change Car Park/Location]
- c. Auto-Identifying vehicles that are parked illegally; [Auto-checking]
- d. Reporting; [View Report]
- e. Sending results to a host computer. [Send Result to Host]

In use, the device (1) is carried or mounted on a vehicle, such as a motorcycle, and the parking enforcement officer rides the motorcycle in the car park to be checked. The parking enforcement officer travels in sufficient proximity to the vehicles parked in the parking lots in the car park such that, for each parked vehicle, the vehicle ID reader RF antenna (6) can read the vehicle IDs and the parking lot identifier, namely the parking lot type switch (7), can be used to provide the respective parking lot information for the parking lot in which each vehicle is parked. As the parking enforcement officer travels in proximity to the parking lots, he/she visually checks the markings on each parking lot to thereby see what type of parking lot it is. The type of markings on the parking lot indicates the type of parking lot. For example, red markings on a parking lot may indicate a reserved parking lot, white markings may indicate a non-reserved parking lot, and a combination of red and white markings on a parking lot may indicate a partially reserved parking lot (for example, a night season parking lot that is a reserved parking lot in a specified time zone [e.g. night time: 22:30 to 7:00] and is a non-reserved parking lot for the other time zone [e.g. day time: 7:00 to 22:30]). Upon performing the visual check of the markings of each parking lot, the parking enforcement officer enters the type of parking lot into the device (1) using the manually operated parking lot type switch (7). The manually operated parking lot type switch (7) then provides the equipment interface (5) with the respective parking lot information (in this embodiment, being the type of parking lot) for each parking lot, that is being checked, in which each vehicle is parked. The vehicle ID reader, namely the RF antenna (6), provides the equipment interface (5) with the vehicle ID. The microprocessor (2) receives the parking lot information and the vehicle ID from the equipment interface (5) and performs a comparison of the received parking lot information and the received vehicle ID with the information data stored in the SSD memory (3). The microprocessor then determines if the vehicle is parked illegally in the parking lot based on the comparison. If the comparison shows that the vehicle is authorized to be parked in the parking lot that it occupies, the vehicle is determined to be parked legally. In such a case, no enforcement action is required. However, if the comparison shows that the vehicle is not authorized to be

parked in the parking lot that it occupies, the vehicle is determined to be parked illegally. The parking enforcement officer then takes the required enforcement action and issues a parking offence notice.

As previously described herein, the parking lot identifier may be provided in other forms. For example, in other embodiments, the parking lot identifier may be provided as an OCR camera to identify the parking lot boundary, the parking lot color or the parking lot number, or an RF antenna to read an RF tag associated with the parking lot. In such embodiments, the parking lot identifier identifies the required parking lot information, as the parking enforcement officer travels in proximity to each parking lot, without the parking enforcement officer having to manually enter the parking lot information into the device (1). Thus, the parking lot information, like the vehicle ID, is captured automatically by the device (1). The parking lot identifier then provides the equipment interface (5) with the respective parking lot information for each respective parking lot being checked. The parking lot information is received by the microprocessor (2) and is used to determine whether or not the vehicle ID reading is required: for example, if the parking lot is a reserved lot, then the RF antenna (6) reads the vehicle ID of the vehicle parked in the parking lot; however, if the parking lot is a non-reserved lot, then there is no need to read the vehicle ID.

Figure 4 shows an embodiment of the Auto-Checking screen, which shows the results of the Auto-identifying task (item c in the operation tasks list previously set out herein). In the example shown in Figure 4, vehicles with S/N 5 and 7 have been flagged as being parked illegally. The parking enforcement officer would undertake enforcement action, as previously described herein, in relation to these vehicles.

The basic operation flow, when using the device (1) of the present invention for vehicle parking enforcement, may be conveniently set out in a table so that the operations performed by the parking enforcement officer (who operates the device (1)) and the operation performed by the device (1) can be shown side by side.

The table below shows the basic operation flow of the enforcement application system when using the device (1) of the present invention.

Step	Parking Enforcement Officer	Device (1)
1	Power-on the Device (1) and log-in.	Start the application program.
2	Select the car park to be checked using touch screen (9).	Request and receive the season vehicle list for the car park from the season data server via the wireless modem (10).
3	Press [Auto-checking] button on the touch screen (9).	Start auto-identifying task.
4.1	Drive the motorcycle along the parking lots.	Perform auto-identifying for all the vehicles parking in season lots to

6	Press [View Report] and select reporting condition.	Show the required report.
7	Press [Send Result to Host].	Send auto-identifying results to the host computer.
8	Press [Exit].	Exit the program.

Whilst preferred embodiments of the present invention have been herein before described, the scope of the present invention is not limited to those specific embodiments, and may be embodied in other ways, as will be apparent to a skilled addressee.

Modifications and variations such as would be apparent to a skilled addressee are deemed to be within the scope of the present invention.

Claims

The claims defining the invention are as follows

1. A device for determining if a vehicle is illegally parked in a reserved parking lot for parking enforcement purposes comprising

a memory specifically adapted to store the data of the vehicles authorized to park in reserved parking lots wherein the data stored in the memory includes the unique vehicle ID, the type(s) and the location(s) of the reserved parking lots in which parking is authorized, and the related authorized parking periods and time zones,

a visual parking lot identifier specifically adapted to provide parking lot information pertaining to a parking lot, such as lot type and location, based on the detection and identification of the colour of the parking lot boundary line, and of the lot number printed on the ground near to the lot boundary line,

a vehicle ID reader specifically adapted to capture the unique ID of the vehicle that is parked in a reserved parking lot,

an equipment interface specifically adapted to receive at least the parking lot information from the parking lot identifier and the vehicle ID from the vehicle ID reader for the vehicle parking in a reserved parking lot, and

a microprocessor specifically adapted to receive the parking lot information and the vehicle ID via the equipment interface and to compare the received parking lot information and the received vehicle ID with the information data stored in the memory, and determine if the vehicle is parked illegally in the reserved parking lot based on whether the vehicle is parked in a parking lot which it is not authorized to occupy.
2. A device according to claim 1, wherein the list of the authorized vehicles contains at least one vehicle ID for each vehicle and the information pertaining to the associated parking lots.
3. A device according to claim 2, wherein the vehicle ID includes one or more of the following: the vehicle license plate number; the number of an in-vehicle electronic label, unit, or device; or the number of an RFID transponder or tag associated with the vehicle.
4. A device according to any one of the preceding claims, wherein the vehicle ID reader includes one or more of the following: an OCR camera for capturing the vehicle license plate number; RF antenna for reading the number of an in-vehicle electronic label, unit, or device; a RFID reading for reading the number of a transponder (or a tag) associated with the vehicle.
5. A device according to claim 1 or 2, wherein the parking lot information includes one or more of the following: parking lot type or lot number.
6. A device according to claim 5, wherein the parking lot type includes one or more of the following: normal, reserved whole-day season, night season, handicap, or other special types.

7. A device according to any one of the preceding claims, wherein the visual parking lot identifier includes one or more of the following: a manually operated switch; a camera system to differentiate the parking lot types.
8. A device according to any one of the preceding claims, further comprising an alarm to issue an alert when the microprocessor determines that a vehicle is parked illegally in a reserved parking lot.
9. A device according to claim 8, wherein the microprocessor is coupled to the equipment interface such that the alarm is issued when the microprocessor determines that a vehicle is parked illegally in a reserved parking lot.
10. A device according to any one of the preceding claims, further comprising a wireless modem for the device to communicate with a server and/or host computer to download the data relating to reserved parking lots and the data relating to authorized vehicles and to report the identification and determination results.
11. A device according to any one of the preceding claims, further comprising one or more indicators to show the operation status of the device.
12. A device according to any one of the preceding claims, further comprising a touch screen monitor to input operation instructions into the device and/or display information.
13. A device according to any one of the preceding claims, wherein the vehicle ID reader is adapted to capture the vehicle ID of a vehicle that is parked in a parking lot only if the parking lot is reserved for authorized vehicles.