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IN-VEHICLE ELECTRONIC PARKING SYSTEM AND METHOD OF OPERATING THE SAME

FIELD OF THE INVENTION

This invention relates to an in-vehicle electronic parking system and a method of operating the same. More particularly, the present invention relates to an in-vehicle electronic parking device and parking cards to be used in conjunction with.

DESCRIPOTION OF THE PRIOR ART

Currently, there are various vehicle-parking systems including parking meters, parking gantry systems, pre-paid parking coupon systems and portable personal parking meters.

The relatively old parking meters are limited to acceptance of monetary coins, notes and tokens for operation. The user of a parking space needs to predict the parking time and use correct total amount of coins, notes and tokens. Under-prediction of the parking time causes parking overstay resulting in getting a parking offence ticket. Over-prediction of the parking time causes over-payment for the parking. The parking meters can not function without coins, notes and tokens. Also, worn coins, notes and tokens are sometimes not acceptable by the parking meters because the meters have high accuracy of monetary verification functions. Parking enforcement officers need to frequently empty the parking meters. The meters need to be reset when changes of the parking tariffs are required. When the meters are not computerised, resetting of the meters requires a lot of manpower.

The parking gantry systems provide the users of the enclosed parking area convenience of no need for prediction of the parking time. Parking charges can be paid at either the exit gantries or self-service parking pay-stations. Operation of the enclosed parking systems, however, is expensive and they are commonly seen as privately-operated parking facilities instead of open ones.

The pre-paid parking coupon systems also require the users of the parking space to correctly predict the parking time, and accurately indicate on the parking coupons the parking zone,

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rates, time and date. Unsure indication of the parking coupons is a parking offence. When parking tariff changes, new coupons need to be issued and old ones become obsolete.

In recent times, it has become possible to pay parking fees with different types of parking cards through portable personal parking devices. The device is placed on the dashboard in side of the vehicle, or in a place where it can be seen. The parking card is inserted into the device for recording the parking time, space and fees. The users of the parking space press buttons to turn the device on, choose the parking zone they are parking in for the correct parking rates, and turn it off when they return to the vehicle.

According to one known system, the parking card is exchangeable. This renders it attractive to steal the parking cards. One known system stated that the operation of the parking device can be renewable. However, that is a labour-intensive way of renewal of the operation of the parking system.

SUMMARY OF THE INVENTION

The present invention solves some of the problems which have not been solved or raised by the previous known methods and devices, specifically provides a parking system which provides means whereby the system is of no use to a thief as the parking cards and the device must match the number of the vehicle, which provides means whereby the time of parking overstay is allowed and no prediction of the parking time is needed, and which provides means whereby its operations, e.g. parking tariffs, can be renewed in a simple, cost–effective and almost-free-of-labour way.

The general purpose of the invention, therefore, is to provide a motorist a parking system and its operation method, which is most convenient and fairest.

The invention provides means whereby the parking system is operated by integrated circuit (IC) system.

The invention also provides means whereby a motorist pays the parking fees using a parking card, in which a monetary value is stored and can be topped up or refilled.

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The invention further provides means whereby the parking enforcement officer can use a remote control to detect whether the parking system is being set properly to pay for correct parking fees or not.

Last but not least, the invention provides means whereby parking lights or display can show whether renewed operation of the parking system, e.g. the parking tariffs, is being used or not. The parking officers also observe the parking lights to detect whether the parking system is being set properly to pay for correct parking fees or not.

Other means provided by the parking system will appear as the description of the present invention proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of an in-vehicle electronic parking system embodying the present invention.
Figure 2 is a block diagram schematically showing the structure of a preferred embodiment of the invention.
Figure 3 is a block diagram showing the general process of a preferred embodiment of the invention.
Figure 4 is a block diagram showing the process of a preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The parking system, as shown in Figure 1, comprises a parking device 10, parking cards 18, a master parking card 21, a parking remote control 22, and one or more functional modules 9, e.g. Electronic Road Pricing.

The parking device 10 has its built-in microelectronic ICs and memories, which store information of the vehicle, the parking cards and the parking tariffs. The parking device 10 has its unique identification number stored electro-magnetically, e.g. the vehicle number. The device 10 is placed or installed inside of the vehicle, where it can be seen. When the vehicles have no enclosed space where the parking device can be placed and seen, e.g. motorcycle, a special gadget is provided to accommodate and secure the parking device 10 and the parking

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cards 18, and protect from rain, snow, theft and etc. The parking device 10 is built in such way that unauthorised opening of its case causes malfunctioning of the system. The cards 18 and 21 are introduced into a slot 11 of the parking device 10. However, the cards 18 and 21 can be detected and introduced in other ways, e.g. outside of the slot 11 of the parking device 10, in which case the cards 18 and 21 and the parking device 10 do not need to contact each other, and communication between them remotely can be achieved. The types of the parking cards 18 and 21 include cash card, cash card with identification number electro-magnetically stored in it, smart card with identification number, and any pre-paid cards with magnetic strips, identification number and microelectronic ICs, which are well know to persons skilled in the art. The parking cards can store monetary values and be topped-up at the banks' Auto-Teller Machine (ATM) and the alike. The identification numbers of the parking device 10 and parking card 18 must match or be the same for functioning of the parking system. The parking cards 18 and 21 have built-in microelectronic ICs and memories 20 including Random Access Memory (RAM) and Read Only Memory (ROM) which store information of the card owner and the parking tariffs. One of ways to renew the parking tariffs is to reset the parking device 10. Another way is to issue new parking cards 18 to all the users of the parking device 10. The new parking cards 18 store electro-magnetically the new tariffs which can be read, transferred into and stored in the parking device 10 when the new cards 18 are inserted into or detected remotely by the card slot 11.

The parking device 10 has one or more displays 12 which show parking zones, parking charge rates, real time, monetary balance of the parking cards 18, information of previous parking, and any other information needed.

The parking device 10 has a keypad 13 comprising key 13A, key 13B and key 13C. Key 13A and key 13 B define parking zones correlating parking rates. Pressing key 13A gives alphabetical letters from A to Z. Pressing key 13B gives numbers from 0 to 99. Key 13C is used to start to count the parking time.

The parking device 10 has parking lights 14 comprising one or more lights in different colours. Each light 14 correlates an edition of the parking tariff. The lights 14 will be lit only when the parking device 10 functions correctly and is set and being used properly. The parking lights 14 can be combined with the display 12, and become a part of the display 12, which can provide the functions of the parking lights 14.

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The parking device 10 has a cable 15 connecting to the vehicle battery, which supplies power.

The parking device 10 has a solar battery 16 as a supplementary supply of power.

The device 10 has a real-time clock 28 (referring to Figure 2) operated by a battery 8. When the power of the battery 8 is low, a beep alarm and display of the clock battery of "low battery" will be shown when the parking cards 18 are inserted into the slot 11 or detected, so as to remind the user to replace the clock battery 8. The parking device 10 functions in such way that when the vehicle battery 15 and the solar battery 16 have electricity, the clock battery 8 does not consume its electricity.

The parking device 10 has a remote sensor 17 that is a combination of receiver and transmitter. When it receives a remote signal from the parking remote control 22, the sensor 17 transmits information of the parking device 10 to a parking remote control 22.

The parking cards 18 have the information of the parking device 10 and the owner of the vehicle. The parking cards 18 also have the identification number which can be the vehicle number 19, for example, and can be printed on the surface of the parking cards 18. The master parking card 21 has no identification number. When the parking cards 18 are lost, the master parking card 21 is used to read out from the parking device 10 the information of the parking cards 18 and the previous parking charges. The parking cards 18 and the master parking card 21 preferably meet the international standard requirements of the credit cards, e.g. dimensions.

The parking remote control 22 is used by the parking enforcement officer to check the parking device 10 is being used properly for paying for the parking charges or not. A mini-printer 23 is installed in the parking remote control 22, to print out the results of the parking check.

Figure 1 shows schematically the layout of various items of the parking device 10. The positions and functions of the items of the parking device 10 can be adjusted and combined by persons who are skilled in the art.

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Figure 2 shows a preferred embodiment of the parking device 10 of the present invention. The operational centre of the parking device 10 is the central processing unit (CPU) 24. The CPU 24 has Random Access Memory (RAM) 25 and Read Only Memory (ROM) 26 to store all the necessary information about the parking and other functions 9, e.g. Electronic Road Pricing. The parking device 10 processes data, calculates parking charges, keeps the parking tariffs, keeps the real time, controls the parking lights 14, supplies power, stores data of the parking cards 18 and 21, etc., which is well known to persons skilled in the art.

The parking cards 18 and 21 communicate with the CPU 24 through a card reader/writer 27 or remotely, which is an IC interface. When a new parking tariff is to implement, the parking cards 18 with new parking tariff are inserted into or detected remotely by the card slot 11, and the new parking tariffs are transferred into and stored in the CPU 24 through the card interface.

The CPU 24 receives information of the parking zones from the keypad 13. When the CPU 24 assesses and concludes that the parking system and the other integrated functional modules 9 are working properly, the parking lights 14 will be lit or the display 12 will show. The CPU 24 processes the data and sent to the display12. The integrated functional modules 9 can function with the parking system independently. The power 15 and 16, the remote sensor 17 and the clock 28 communicate with the CPU 24.

Figure 3 shows a general preferred process of the parking system. The power module provides power to the whole system. The card verification verifies the parking cards. ERP module communicates with the ERP control module. The parking module accepts commands for parking and also communicate remotely with the parking remote control. The display module displays data transferred from the ERP module and the parking module. The data processing module processes and manages all the data for the ERP module and the parking module.

Figure 4 elaborates the preferred process of the present invention, which is described in Figure 3. The parking cards 18 and 21 work as a switch to turn on the power of the parking device 10 when inserting the cards 18 and 21 into or being detected by the card slot 11. The CPU 24 will first verify the identification numbers of the parking device 10 and the parking

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cards 18; if the numbers match, the process continues. Otherwise, a beeping alarm sounds and the process ends. When the master parking card 21 is inserted, any parking device 10 can proceed without checking for the identification numbers. The master parking card 21 is only issued to the administrators and service centres of the parking system. The master parking card 21, which does not have the identification number, is used in case a motorist's parking card 18 is lost. Since the information of the previous parking charges and other charges including parking rates, venues/places, time, charges and etc., up to 100 previous charge transactions, are stored in the parking device 10, the master parking card 21 can retrieve the information, and the monetary value of the lost parking card can be refunded to the card owner. Of course, when the parking cards 18 are inserted into the slot 11, all the above-mentioned information can also be retrieved.

The next process of the workflow is to check if the parking cards 18 store the information of new parking tariffs or not. If yes, the CPU 24 reads the new tariffs and downloads into the parking device 10. The CPU 24 also set the register of the parking lights 14 to be a next parking light, and from the current parking onwards, the new parking light will be lit. The use of different colours of the parking lights 14 for the purpose of changes of the parking tariffs can be recycled, hence, two parking lights 14 in different colours are enough for many times of changes of the parking tariffs. The parking lights 14 are in different colours so as for the parking enforcement officer to tell which edition of tariffs is being used easily from a distance.

The CPU 24 checks the parking cards 18 if the parking cards 18 have positive monetary value or not. If the value is positive, the process continues.

The monetary value of the parking card 18 is negative now. The process checks the parking cards 18 if the parking cards 18 have a debt of parking and ERP charges in previous parking and ERP transactions, in other words, the balance of the previous parking and ERP was negative. If there is not debt, the process beeps and ends, and the user needs to top up the cards 18. If there is a debt, the CPU 24 will deduct this debt at this step. Upon completion of the deduction, the CPU 24 checks again the parking cards 18 if the parking cards 18 have positive monetary value or not. If the value is negative, the process beeps and ends. If the value is positive, the process continues, and a parking light 14 is lit.

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The process for the parking and other functions 9 now continues independently in two parallel routes. One is the integrated functional modules 9, e.g. the Electronic Road Pricing. The modules 9 communicate with their controls, either remotely or through cable connections, and certain amount of monetary value is deducted accordingly. Another route is parking charge. The parking keypad 13 is used to key in the parking zones by pressing keys 13A and 13B and start the parking charge by pressing key 13C. The monetary value stored in the parking cards 18 will be deducted every certain minutes as the parking time elapses. The parking information, such as the parking zone, real time, date, the monetary value of the parking cards 18, and the information data of the other functional modules 9, are constantly processed and stored in the CPU 24 and the parking cards 18. The charging process comprises means allowing that monetary value of the parking card 18 is deducted to have a negative value, i.e. the charge debt is allowed.

When a motorist returns to the vehicle, the parking card 18 is taken out from the parking card slot 11, and the parking process ends.

When a parking enforcement officer positions the parking remote control 22 to the remote sensor 17 of the parking device 10 and sends a signal, the remote sensor 17 of the parking device 10 receives the signal and the CPU 24 sends out the parking information to the parking remote control 22 through the parking sensor 17. When the parking device 10 is off, the signal from the parking remote control 22 can switch on the parking device 10, and the CPU 24 sends out the parking information to the parking remote control 22 through the parking sensor 17. If the parking information shows that the parking is not in line with parking rules, the mini-printer 23 of the parking remote control 22 will print out a parking offence ticket.

The parking cards 18 are issued with a deposit of monetary value. The value is determined by a possible maximum parking overstay charge, say one-day parking charge at a most expensive parking tariff. Since the parking process allows the parking debt, this deposit will enable the motorist to return the used-up parking cards 18 for reuse and topping-up of card value.

When the parking cards 18 are cash cards, storage of the identification numbers in the cash cards and the parking device 10 and checking for matching of the identification numbers are

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not needed. The method of operating the system will be amended. At beginning of each parking, the cash card 18 is inserted in to the card slot 11 and then taken out. The cash card 18 can also be taken out during the course of parking. The parking device 10 processes data for the parking charges and other charges regardless the cash card 18 remains inserted in the slot 11 or not. When the motorist returns the vehicle, he either inserts the cash card again for deduction of the parking charge from the cash card 18 then take out the cash card, or press the start key 13C again to stop the counting of parking time. Whenever he inserts a cash card 18 again, the outstanding parking charge will be deducted first before the new parking process starts.

Renewal of the parking tariffs when using cash cards 18 works in the same way as using the parking cards 18 with the identification number.

The information of the parking transactions can be viewed and printed at ATMs and the alike of the administrators of the parking cards 18 and banks.

While only a few embodiments of the present invention have been described and illustrated, it is to be understood that many changes, modifications and verifications could be made to the parking system of the present invention without departing from the scope or spirit of the invention.

The parking system and a method of operating the same have been described above in relation to a parking system. The invention, however, equally applicable to other time-based charging devices or systems and the invention is not limited to parking systems.

CLAIMS

1. A method of operating an in-vehicle electronic parking system comprising an in-vehicle parking device and parking cards, the method comprising the steps of: detecting the parking cards by the card reader/writer; verifying the information stored in the parking cards; checking for new parking tariffs; checking for monetary balance of the parking cards; deducting previous charging debts; displaying the system information; keying in parking parameters; deducting the parking and other charges; processing and storing data

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in the parking cards and the device; alarming for incorrect functioning of the parking cards and device; and renewing the parking tariffs.

2. A method according to claim 1, wherein the parking device comprises means for renewal and storage of new parking tariffs.
3. A method according to claim 1, wherein the parking device comprises parking lights.
4. A method according to claim 3, wherein the parking lights comprises means showing the parking system being functioning properly.
5. A method according to claim 4, wherein the parking lights comprises means showing editions of the parking tariffs.
6. A method according to claim 1, wherein the parking device comprises a display.
7. A method according to claim 3, 4, 5 and 6, wherein the display comprises means for providing the functions of the parking lights.
8. A method according to claim 1, wherein the parking cards comprises cash cards.
9. A method according to claim 1, wherein the parking cards comprises cash cards with identification numbers.
10. A method according to claim 1, wherein the parking cards comprises smart cards.
11. A method according to claim 1, wherein the parking cards comprises pre-paid cards.
12. A method according to claim 1, wherein the parking device comprises means communicating with the parking cards remotely.
13. A method according to claim 1, wherein the system comprises means allowing deducting monetary value of the parking cards to negative monetary value.
14. A method according to claim 1 and 8, wherein the system comprises means allowing the cash cards being taken out of the parking device during counting of the parking time and charging of the monetary value of the cash cards.
15. A method according to claim 1, 8, 9 10 and 11, wherein the parking cards comprise means storing the parking tariffs.
16. A method according to claim 1, 8, 9 10, 11 and 15, wherein the parking cards comprise means transferring the new parking tariffs into the parking device.
17. A method according to claim 1, wherein the parking cards comprises means retrieving information of previous parking charges and other charges.
18. A method according to claim 1, wherein the parking device comprises identification number.
19. A method according to claim 1, wherein the parking card comprises identification number.

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20. A method according to claim 18 and 19, wherein the parking device comprises means matching the identification number of the parking cards.
21. A method according to claim 1, wherein the parking device comprises a keypad.
22. A method according to claim 21, wherein the keypad comprises a key by pressing to give one of a letter from A to Z.
23. A method according to claim 21, wherein the keypad comprises a key by pressing to give one of a number from 0 to 99.
24. A method according to claim 1, wherein the parking device comprises means allowing other functions functioning independently.
25. An in-vehicle electronic parking system comprising an in-vehicle parking device and parking cards.
26. A system according to claim 25, wherein the parking device comprises a central process unit, parking card reader/writer, display, keypad and real-time clock.
27. A system according to claim 25, wherein the parking cards comprise integrated circuits and memories.
28. A system according to claim 25, wherein the parking system comprises a parking remote control.
29. A system according to claim 28, wherein the parking remote control comprises a remote sensor and a printer.
30. A method of operating an in-vehicle electronic parking system substantially as hereinbefore described with reference to and as shown in the accompanying drawings.
31. An in-vehicle electronic parking system substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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