

VEHICLE PARKING METER SYSTEM**Field of the invention**

5

The present invention relates to a vehicle parking meter system and in particular to a vehicle mountable meter unit and associated interrogating unit which may be used to determine the status of the vehicle meter unit.

10 **Background of the Invention**

Roadside and other unenclosed car parks are not uncommon. Present systems for collecting payment from motorists using such facilities include coin operated parking meters, cash-operated ticket dispensing machines (wherein
15 tickets are displayed in the vehicle), and pre-purchased coupons (also for display in the vehicle) with tabs indicating time and date of commencement of parking to be torn off.

Disadvantages of the prior art systems include vulnerability to vandalism
20 and a requirement that the motorist have cash in hand. Cash operated meters and machines also need to be maintained and require collection personnel to periodically service the meters/machines. Pre-purchased coupons also have short-comings in that a situation frequently arises where a motorist has reached his destination and parked his car only to discover that he has exhausted his
25 stock of coupons. The motorist then has to obtain more coupons from an outlet such as a newsagent or petrol station or another motorist. While he does so his vehicle will be illegally parked and he may be issued with a penalty notice.

Although vehicle mounted parking meter units are known, the known
30 arrangements generally require visual inspection by a parking control person. It is desirable to provide a vehicle mounted parking meter system wherein the status of the parking meter unit can be determined from a remote location and wherein, if appropriate, a penalty notice may be issued in response to a showing of an inactive or otherwise invalid status of the parking meter unit.

35

Summary of the Invention

The present invention may provide a vehicle mounted parking meter unit
5 (PMU) for regulating parking. The PMU may include an electronic meter. In
operation, a motorist, upon parking his car, may insert his smart card (which
has a stored value, refillable at an Automatic Teller Machine or the like) into the
PMU. Depending on the zone in which the vehicle is parked, the motorist may
10 activate the PMU by pressing a button marked with the parking rate applicable
in that zone. Once the PMU is activated, the smart card may be continuously
debited until such time as the motorist cancels the operation by pressing
another button or when the smart card value is exhausted.

For enforcement purposes, i.e. to check if the PMU is active as described
15 above, a traffic warden may be issued with an interrogating unit. The traffic
warden may use the interrogating unit to query if the PMU is active or has an
otherwise invalid status (eg. inappropriate parking rate selected for the zone in
which the vehicle is parked). If the PMU is not active or has an invalid status,
the interrogating unit can indicate an appropriate penalty based on one or more
20 pre-programmed algorithms. The interrogating unit may include a control panel
and a display panel. The interrogating unit may use wireless communications to
exchange data with the PMU.

The PMU may include a smart card reader module, a display module, a
25 real time clock module, a transceiver module and a micro controller or
microprocessor programmed to control the preceding modules. The display
module may include a liquid crystal display (LCD) panel. The transceiver
module may include an infrared transceiver. The micro-controller may include
an Intel circuit type 87C52 or equivalent.

30

The smart card reader module may deduct value from an inserted
stored-value card. The display module may provide a window of communication
to users. The real time clock module may provide to the micro-controller signals
at regular intervals to inform the latter when to deduct value from the stored-

value card. The PMU may include a plurality of user selectable parking rates. Preferably stored value deduction takes place between set active hours, eg. between 0800 to 1700 hours. If the time falls outside of the active hours, the PMU may enter a standby mode until the time reaches the active hours. The
5 PMU may include beeper and LCD display warnings for low value card, invalid card, and as a prompt/reminder to select an appropriate parking rate. The transceiver module may enable communication to the outside world. In one form the transceiver module may provide communication with the interrogating unit issued to the traffic warden.

10

The interrogating unit may interrogate the PMU to ascertain if the PMU and any inserted stored-value card are authentic. The interrogating unit may interrogate the PMU for a user selected parking rate and for any unexpired time (time elapsed since the stored value last depleted while being deducted). This
15 information may allow the traffic warden to compose a correct penalty to impose. The warden may be able to send information such as a penalty message directly to the PMU via the interrogating unit, to inform the driver of the amount he is being fined. This information may appear on the PMU's LCD display panel so that the driver can be conveniently informed.

20

Additionally or alternatively the interrogating unit may be integrated or associated with printing means for printing of a penalty notice. The printed penalty notice may be affixed to the offending vehicle or it may be posted to the registered owner of the vehicle. Where a penalty message was sent directly to
25 the PMU, the printed notice may serve as a confirmation of the penalty or to draw to the attention of the owner/driver of the vehicle that the penalty message was sent.

The system may include a top-up unit for topping up the value of the
30 smart card. The top-up unit may include a micro-controller and a smart card reader. The top up unit may also include an LCD display panel to show the old value (before top-up), topping-up value and a new value after top-up.

According to the present invention there is provided a parking meter unit suitable for mounting in a vehicle, said parking meter unit including:

processing means;

timing means for supplying timing signals to said processing means;

5 card reading means for deducting value from a stored value card under control of said processing means; and

transceiver means operably associated with said processing means for exchanging data with an interrogating unit, said interrogating unit being adapted to determine a status of said parking meter unit remote from said parking meter unit.

10

According to a further aspect of the present invention there is provided a parking meter system including:

a parking meter unit suitable for mounting in a vehicle, and an
15 interrogating unit adapted to interrogate a status of said parking meter unit remote from said parking meter unit;

said parking meter unit including:

processing means;

20 timing means for supplying timing signals to said processing means;

card reading means for deducting value from a stored value card under control of said processing means; and

transceiver means operably associated with said processing means for exchanging data with said interrogating unit.

25

Description of a Preferred Embodiment

A preferred embodiment of the present invention will now be described with reference to the accompanying drawings wherein:

30

Fig. 1 shows a vehicle mounted parking meter system according to the present invention;

Fig. 2 shows a block diagram of a PMU;

Fig. 3 shows a front panel of a PMU;

Fig. 4 shows a power up function associated with the PMU;

Fig. 5 shows a card slotting and selection function associated with the PMU;

Fig. 6 shows a time and date setting function associated with the PMU;

5 Fig. 7 shows a warden interrogating unit;

Fig. 8A-8F show power up, enquiry, penalty and reset functions associated with the interrogating unit;

Fig. 9 shows a smart card top up unit;

10 Fig.10A and 10B show power-up and top-up functions associated with the top-up unit;

Fig. 11 shows a flow chart of software associated with the smart card reader;

Fig. 12 shows a flow chart of software associated with accessing data from the smart card;

15 Fig. 13 shows a flow chart of software associated with operation of the parking meter unit;

Fig. 14 shows a flow chart of software associated with an interrupt sub-routine (from RTC interrupt pin);

Fig.15 shows a flow chart of software associated with time status;

20 Fig. 16 shows a flow chart of software associated with an interrupt sub-routine (time-setting);

Fig. 17 shows a flow chart of software associated with an interrupt sub-routine (from interrogating unit);

25 Fig. 18 shows a flow chart of software associated with operation of the interrogating unit;

Fig. 19 shows a flow chart of software associated with the interrogating unit (functional flow); and

Fig. 20 shows a flow chart of software associated with reading of data and conversion of ASCII code.

30

Fig.1 shows a vehicle mounted parking system including an electronic parking meter unit (PMU) 10 and an interrogating unit 11. When activated PMU 10 continually deducts from an inserted pre-paid stored value or smart card an amount corresponding to a user selected parking rate while the associated

vehicle is parked. A car park warden uses a portable interrogating unit 11 to communicate with PMU 10 via an infra-red communication link. Based on information returned by PMU 10, the warden is able to determine if the correct parking rate is selected and if the smart card has depleted. The system also
 5 includes a top up unit for topping up stored value of a depleted smart card.

Fig 2 shows a block diagram of a PMU including micro-controller 20, smart card reader 21, LCD display panel 22, real time clock 23 and infra-red transceiver 24. Smart card reader 21 deducts value from the smart card
 10 inserted in smart card reader 21. LCD display panel 22 provides a window of communication to users. Real-time clock 23 provides micro-controller 20 with regular fixed-interval signals to inform it to perform, together with the smart card reader 21, real-time deduction from the smart card. Infra-red transceiver 24 enables communication to the interrogating unit carried by the car-park warden.

15

Fig 3 shows a front panel of a PMU. LCD display panel 30 displays information including smart card value, calendar data (date and time), instructions and important messages. Infra-red transceiver window 31 allows
 20 the PMU to communication with the car park warden's interrogating unit via a wireless communication link. Slot 32 is associated with a card reader mounted in the PMU. The smart card reader may be a device type GCI400 or GCI410 and may include a full range of interfacing functions. The smart card which is inserted into slot 32 holds prepaid value for deduction.

25 A buzzer or other sound transducer which is arranged to emit a sound that varies in tone, tune or otherwise according to a selected parking rate and/or mode of operation, may indicate to the user parking rates which have been chosen and/or whether the PMU is in active or in standby mode. Active mode may indicate that deduction is in progress and standby mode may indicate that
 30 deduction will start when the PMU reaches a current time status.

The PMU may be powered via a power adaptor provided with the unit. A power switch is located on the back plane of the PMU. Following power-up the

user should follow instructions displayed on the PMU as shown in Fig. 4; by selecting

- * REAL Mode – a normal operation which perform a deduction every 5 minutes, or
- 5 * TEST Mode – for testing and demonstration purposes which performs a deduction every 5 seconds.

The user places the smart card in slot 32 ensuring that the card contact is face down. If the card value is below 100 Baht, there will be two short “beep”
 10 sounds and a message will display on LCD panel 30 as shown in Fig 5. The user may then choose the appropriate rate. The user may depress the “TIME SETTING” button for setting the time and a display will appear as shown in Figure 6. The button marked “12B/▲” is used to increase the time and date. The button marked “24B/►” is used to change the position of the cursor. The button
 15 marked “FULL/◎” is used to save a new time setting. Depressing the “TIME SETTING” button again will cause the device to resume normal operation. If the button is not depressed, the device will resume normal operation after 10 seconds.

20 An example of the operation of the PMU is as follows:
 Park between 0800 hours and 1700 hours

No indication is displayed on the PMU until a smart card is inserted. The buzzer will sound to alert the driver if a smart card is inserted but no parking
 25 rate has been selected. If a parking rate was selected before 8.00 am, the sound transducer will indicate a change from standby mode to active mode.

When the ‘12B’, 24B’ or ‘FULL’ button is depressed, the sound transducer will change its tone (denoting that deduction is activated). Deduction
 30 will only be performed while the button is depressed. ‘12B’ denotes 12 Baht per hour and ‘24B’ denotes 24Baht per hour. ‘FULL’ denotes 88 Baht per day. For ‘12B’ and ‘24B’, the deduction is carried out evenly every 5 seconds (in test mode) or 5 minutes (in real mode). For a full day’s parking, 88 Baht will be

deducted in a single transaction when the button is pressed. All rates will be reset when the smart card is removed from the PMU.

- 5 If the smart card value is insufficient for the next deduction, no deduction will take place. The buzzer will sound every 2 seconds and the timer will start to record the expired time. The expired time information will be displayed on the LCD screen.

Park between 1700 hours and 0800 hours

- 10 The PMU will not perform any deduction. Any rate selected will turn to standby mode and, the sound transducer will change its tone.

The PMU may include the following functional features.

- Three user-selectable rates: 12 Baht /hr (1 Baht per 5 min)
 24 Baht/hr (2 Baht per 5 min)
 15 full-day parking (0800hrs to 1700hrs)
 Active (deduction) hours: 0800 hrs to 1700 hrs

- 20 After the card has been inserted and the parking rate selected, stored-value deduction will only take place when the time of day falls between 0800 hrs and 1700 hrs.

- 25 Standby mode: Stored-value deduction at the selected parking rate will only occur during active hours. If the time falls outside of the active time period between 0800hrs and 1700hrs, the PMU enters standby mode until the time reaches 0800 hrs, when deduction will commence.

- 30 Warnings: Beeper and/or LCD display warnings
 a) for low-value card
 b) for invalid card
 c) as a prompt/reminder to select the parking rate

Other displayed information: Information received from the warden interrogating unit such as the penalty amount.

Date and time-of-day information.

Fig 7 shows a warden interrogating unit. LCD display panel 70 is the window of communication with the interrogating unit. LCD panel 70 displays information received from the PMU including the RATE chosen and/or any expired time. The on/off button is located on the right of the unit. Upon power up the unit displays the message shown in Fig 8A. Activation of the ENQUIRE button forwards a request to the PMU for the rate chosen by the car driver. LCD display panel 70 will display the message shown in Fig 8B.

10 If the returned message is CHOICE : 12 Baht/HR
EXPIRED
FINE required!
00HR 10 MIN

as shown in Fig 8C, the warden should follow instructions by activating the button marked FINE. Once the penalty step is executed, the following message will appear:

FINE 500 Baht
Please confirm action

as shown in Fig 8D. Action is confirmed by activating the FINE button again.

20 Following activation the action will be confirmed:

FINE SENT

as shown in Fig 8E. If the action is not confirmed by activating the FINE button again, the penalty step will be cancelled and the message

Action was cancelled

25 Please try again

will be displayed as shown in Fig 8F. The interrogating unit should also be able to query the authenticity of a PMU unit.

The interrogating unit may include an integrated or associated printer unit for printing a penalty notice. The interrogating unit may include a 'PRINT' button (not shown) for activating the printer unit. The printer unit may be a mini-printer or palmtop printer suitable for hand-held devices as commonly available in the marketplace. Incorporation of the printer unit with the interrogation unit is

within the capabilities of the notional skilled addressee and will not be described herein.

Fig. 9 shows a smart card top up unit. The top-up unit includes LCD
5 display panel 90 for displaying information such as old value, top-up value and new value. LCD panel 90 may also show when the card is invalid and inform the operator if the top-up amount has exceeded a maximum value.

The top unit includes on/off button 91 and preset value buttons 92. The
10 first four buttons are for choosing as a preset value the amount of monetary value that the card holder wishes to top-up. For example:

Old Value : 423 Baht

Top-up : 1000 Baht

New Value: 1423 Baht

15

The last or fifth button is for pre-setting the card to 200 Baht and is included for testing and demonstration purposes. The top-up unit should be able to verify the inserted card and top-up value. The top-up unit should also be able to display a current value in the stored-value card, a selected top-up value and
20 a final value after top-up.

Upon power up of the top-up unit LDC panel 90 displays

Smart card system

as shown in Fig 10A.

25

Following insertion of a smart card into the slot provided at the top of the top-up unit a button 92 is selected to add value to the card. All information such as old value top up value and new value is displayed as shown in Fig 10B.

30

Finally, it is to be appreciated that various alterations, modifications and/or additions may be introduced into the constructions and arrangements of parts previously described without departing from the spirit or ambit of the present invention. For example although the embodiment of the invention described herein is configured to operate with the Thai Baht it may be readily

reconfigured via suitable software to operate in other world currencies such as USD, GBP, SGD, JPY, HKD etc.



CLAIMS

1. A parking meter unit suitable for mounting in a vehicle, said parking meter unit including:
 - 5 processing means;
 - timing means for supplying timing signals to said processing means;
 - card reading means for deducting value from a stored value card under control of said processing means; and
 - transceiver means operably associated with said processing means for
 - 10 exchanging data with an interrogating unit, said interrogating unit being adapted to interrogate a status of said parking meter unit remote from said parking meter unit.
2. A parking meter unit according to claim 1 including display means for displaying to a user data associated with said status.
- 15 3. A parking meter unit according to claim 2 wherein said interrogating unit is adapted to forward a penalty message to said parking meter unit in response to an invalid status of the parking meter unit, for display via said display means.
4. A parking meter unit according to claim 3 wherein said interrogating unit includes or is associated with printing means for printing a penalty notice.
- 20 5. A parking meter unit according to any one of the preceding claims, wherein said status includes active mode, inactive mode and a user selectable parking rate.
6. A parking meter unit according to any one of the preceding claims wherein said transceiver means includes a wireless infra-red transceiver.
- 25 7. A parking meter unit according to any one of the preceding claims wherein said card reading means includes a smart card reader.
8. A parking meter unit according to any one of claims 2 to 7 wherein said display means includes a liquid crystal display panel.
9. A parking meter unit according to any one of the preceding claims
- 30 including a sound transducer for emitting a sound that varies according to a selected parking rate.
10. A parking meter unit according to any one of the preceding claims wherein said processing means includes a micro-controller.
11. A parking meter system including:

a parking meter unit suitable for mounting in a vehicle, and an interrogating unit adapted to interrogate a status of said parking meter unit remote from said parking meter unit;

said parking meter unit including:

5 processing means;
 timing means for supplying timing signals to said processing means;

 card reading means for deducting value from a stored value card under control of said processing means; and

10 transceiver means operably associated with said processing means for exchanging data with said interrogating unit.

12. A parking meter system according to claim 11 including display means for displaying to a user data associated with said status.

13. A parking meter system according to claim 12 wherein said interrogating
15 unit is adapted to forward a penalty message to said parking meter unit in response to an invalid status of the parking meter unit, for display via said display means.

14. A parking meter system according to claim 13 wherein said interrogating unit includes or is associated with printing means for printing a penalty notice.

20 15. A parking meter system according to any one of claims 11 to 14 wherein said status includes active mode, inactive mode and a user selectable parking rate.

16. A parking meter system according to any one of claims 11 to 15 wherein said transceiver means includes a wireless infra-red transceiver.

25 17. A parking meter system according to any one of claims 11 to 16 wherein said card reading means includes a smart card reader.

18. A parking meter system according to any one of claims 12 to 17 wherein said display means includes a liquid crystal display panel.

19. A parking meter system according to any one of claims 11 to 18 including
30 a sound transducer for emitting a sound that varies according to a selected parking rate.

20. A parking meter unit according to any one of claims 11 to 19 wherein said processing means includes a micro-controller.

