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METHOD AND DEVICE FOR PROCESSING ELECTRONIC SERVICES

This application claims the priority of Chinese Patent Application No. 200910089177.2 filed in SIPO on August 3, 2009 and entitled "METHOD AND DEVICE FOR PROCESSING ELECTRONIC SERVICES", which is incorporated herein by reference in its entirety.

Field of the Invention

The present invention relates to the technical field of smart cards, and more particularly, to a method and a device for processing electronic services.

Background of the Invention

Currently in the process of processing smart card electronic services, the electronic services mainly fall into the following categories in terms of correlations therebetween: independent electronic services, and relevant electronic services related to one or more previous electronic services or related to one or more subsequent electronic services. Wherein, the electronic services include electronic transactions and other services executed by electronic service platforms.

The independent electronic services refer to electronic services that are not strictly related to and relatively independent from previous or subsequent electronic services. This kind of electronic services can be accomplished only by swiping a smart card once. For example, when one checks out at a supermarket, payment by a bank card can be accomplished only by processing the electronic service only once.

The processing of independent electronic services is simple and can be achieved easily. Generally, only such important information as whether both parties of the transaction are legal, whether the balance amount can cover the transaction amount and preventing against accidental power failure needs to be considered. Moreover, processing process of independent electronic services generally must be completed within a duration time. For example, when an electronic service such as depositing money, withdrawing money, bank transferring, balance amount inquiry, etc. is being



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executed through use of an ATM, it must be ensured that the bank card is placed inside the ATM; i.e., no other processing shall be performed on the bank card placed inside the ATM when the aforesaid electronic service is being processed. As another example, when a car is refueled with a fuel card in a gasoline station, the fuel card must also be placed inside the oiling machine.

The relevant electronic services refer to electronic services which are related to previous or subsequent electronic services. For example, when a passenger takes a bus that charges by trip sections, the passenger, according to the general rules, has to swipe his or her bus card both when getting on the bus and when getting off the bus. If the passenger fails to swipe the bus card when getting off the bus, then a charge for the whole trip of the bus will be deducted. As can be seen, there is a necessary link between swiping the bus card when the passenger gets on the bus and swiping the bus card when the passenger gets off the bus, and consequently, there is a necessary link between the electronic service processing process corresponding to swiping the bus card when the passenger gets on the bus and the electronic service processing process corresponding to swiping the bus card when the passenger gets off the bus.

The processing processes of relevant electronic services have several forms. As an example, it is presumed that in a relevant electronic service of getting on and off a bus, the charge for the whole trip of the bus is 2 Yuan and the charge for the current trip is 0.5 Yuan. Then, the first form is as follows: for an electronic service similar to the China's Financial IC card specification of the People Bank of China (PBOC), the smart card will record the charge of 2 Yuan for the whole trip, the stop No. of the bus stop where the passenger gets on the bus, the designation of the bus stop where the passenger gets on the bus, the date, the time, and related information of the bus when the passenger gets on the bus. Wherein, the related information includes a lot of kinds of information such as No. of the Purchase Secure Access Module (PSAM), No. of the bus, the serial No. of the terminal. When the passenger gets off the bus, the smart card will deduct charge of 0.5 Yuan according to the information recorded when the passenger gets on the bus. That is, only one electronic service processing process (i.e., deducting the charge) takes place, and this takes places when the passenger gets off

the bus. If the passenger forgets to or does not swipe the bus card when getting off the bus, the charge of 2 Yuan for the whole trip will be deducted when the electronic service is processed a next time. The second form is as follows: for other kinds of electronic services (e.g., published national or international standards such as the Contactless E-Purse Application System (CEPAS) applicable in Singapore), 2 Yuan will be deducted firstly from the smart card when the passenger gets on the bus, and other information records are just similar to those described in the first form; and when the passenger gets off the bus, 1.5 Yuan will be reimbursed to the smart card through calculation according to the information recorded when the passenger gets on the bus (this is equivalent to a deduction of $2 - 1.5 = 0.5$ Yuan for the current trip). Meanwhile, the service record of the smart card is updated. As can be seen, two electronic service processing processes (i.e., deduction and reimbursement) take place when the passenger gets on and off the bus.

As can be known from the above descriptions, no matter for the first form or the second form, the electronic service processing process when the passenger gets on the bus and the electronic service processing process when the passenger gets off the bus are closely correlated with each other, and it is generally required that the two processing records are continuous; that is, the electronic service processing records when the passenger gets on the bus must exist before the electronic service when the passenger gets off the bus is processed so that the electronic service of this time can be continued according to the processing record of last time.

It is possible that other electronic services take place between the get-on electronic service and the get-off electronic service; for example, the passenger may also use the bus card to purchase a newspaper, recharge the bus card online by using his or her mobile phone or use the bus card for shopping online after getting on the bus that charges by trip sections. Currently, the service information generated when such electronic services between getting on the bus and getting off the bus is executed may affect or disrupt the continuous processing records that are required between getting on the bus and getting off the bus. This may thus cause a false judgment of the card reader and then a false transaction when the passenger getting off the bus swipes the bus card,

which would lead to a certain economic loss of the bus card holder or the bus service provider. Accordingly, the other electronic services taking place between the relevant electronic services may lead to conflicts between the electronic services. At present, there is still no proper solution to the conflict caused by the other electronic services taking place between the relevant electronic services.

Summary of the Invention

Embodiments of the present invention provide a method and a device for processing electronic services, which are intended to solve the problem with the prior art of smart cards that conflicts are caused between electronic services when other electronic services take place between relevant electronic services..

An embodiment of the present invention provides a method for processing electronic services, which comprises:

when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and received related information of a first electronic service is related to the second service information, updating a log file according to each piece of first service information stored in a cache file; and otherwise,

executing the first electronic service, and storing corresponding first service information into the cache file after the first electronic service is executed.

Another embodiment of the present invention provides a device for processing electronic services, which comprises:

a receiving unit, being configured to receive related information of a first electronic service;

a matching unit, being configured to, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored, match the received related information of the first electronic service with the second service information so as to make sure whether they are related;

an updating unit, being configured to, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second

service information, update a log file according to each piece of first service information stored in a cache file; and

a cache unit, being configured to, when the number of pieces of stored second service information corresponding to unfinished relevant electronic services is not one or, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is unrelated to the second service information, execute the first electronic service and store the corresponding first service information into the cache file after the first electronic service is executed.

According to the method for processing electronic services provided by the embodiment of the present invention, only when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of a first electronic service is related to the second service information, will the log file be updated according to each piece of first service information stored inside the cache file; and in other cases, the received electronic service is executed directly and the service information corresponding to the received electronic service is only stored in the cache file without changing service information in the log file. This can avoid conflicts between the electronic services, so reading/writing operations on the smart card by a card reader will not be affected and economic loss of the smart card holder or the service provider can be avoided.

Brief Description of the Drawings

Fig. 1 is a flowchart diagram of a method for processing electronic services according to an embodiment of the present invention;

Fig. 2 is a flowchart diagram of a method for processing electronic services according to a first embodiment of the present invention;

Fig. 3 is a flowchart diagram of a method for processing electronic services according to a related embodiment of the present invention; and

Fig. 4 is a structure diagram of a device for processing electronic services according to an embodiment of the present invention.

Detailed Description of the Preferred Embodiments

An embodiment of the present invention provides a method for processing electronic services, which utilizes a lagging submission scheme to solve the problem with the prior art of smart cards that conflicts are caused between electronic services when other electronic services take place between relevant electronic services. Wherein, the electronic services include electronic transactions and other services executed by electronic service platforms.

In embodiments of the present invention, a smart card comprises a log file and a cache file therein, both of which are used to store service information of electronic services. Wherein, the service information stored in the log file can be read by a card reader associated with the smart card, while the service information stored in the cache file cannot. In other words, the cache file is an internal file of the smart card, and the service information in the cache file can be read by the processing unit of the smart card but cannot be obtained by any unit disposed outside the smart card.

The service information generally includes: a service instruction, an instruction identification, a balance amount of the smart card, a service amount of the current term, a service count, or a service record. Wherein, the smart card can judge whether electronic services are correlated or not with each other according to service instructions or instruction identifications .

Service information corresponding to an unfinished electronic service stored in the smart card (i.e., second service information) may be stored in the log file or in the cache file or in both. Of course, it is also possible that there is no service information corresponding to any unfinished relevant electronic service in the smart card; i.e., there is no second service information in the smart card.

For example, a new kind of smart card is used to take a bus that charges by trip sections. Before the passenger gets on the bus, no second service information exists in the smart card; and when the passenger getting on the bus swipes the smart card, the get-on electronic service is executed. Hence, the get-on electronic service is an unfinished relevant electronic service, thus a service information corresponding to the

get-on electronic service is the second service information stored in the smart card. Specifically, the second service information may includes: a get-on instruction or a get-on instruction identification, a balance amount of the smart card which is 10 Yuan, a stop No. of the current stop which is 13, a time of 8:00 a.m., a PSAM No., a serial No. of the card reader, etc.

Referring to Fig. 1, when other electronic services take place between relevant electronic services, the processing process comprises:

Step 101: receiving related information of a first electronic service.

The smart card may communicate with card reader via a communication interface to receive the related information of the first electronic service, or receive the related information of the first electronic service from a wireless network via a communication interface. Here, the related information generally includes a service instruction, an instruction identification, a service amount, a service time, etc.

For example, a recharging service is received in Wi-Fi wireless manner. In this case, the related information includes: a recharging instruction, a service amount of 100 Yuan, a time of 8:20 a.m., etc. In another example, a get-off electronic service is received when a passenger getting off a bus swipes the bus card. In this case, the related information includes: a get-off instruction, a stop No. of the current stop which is No. 20, a time of 9:00 a.m., etc.

Step 102: judging whether only one piece of second service information corresponding to a unfinished relevant electronic service is stored? If the answer is yes, then step 103 is executed; and otherwise, step 105 is executed.

Service information corresponding to each electronic service that has been executed is stored in the smart card; that is, both service information corresponding to independent electronic services and service information corresponding to relevant electronic services are stored. When a relevant electronic service has not been finished, the service information corresponding thereto is just the second service information. For example, when a passenger uses the smart card to take a bus that charges by trip sections and has swiped the card when getting on the bus, the get-on service is closely related to the subsequent get-off service. In this case, the get-on service is a relevant

electronic service and has not been finished, and the stored service information corresponding to the get-on service that has been executed is the second service information.

Here, a search must be made in both the cache file and the log file of the smart card to judge whether only one piece of second service information corresponding to a unfinished relevant electronic service is stored. If the answer is yes, then step 103 is executed; and otherwise, step 105 is executed.

For example, a new kind of smart card is used to take a bus that charges by trip sections. When a passenger getting on the bus has swiped the card, only one piece of second service information corresponding to the unfinished relevant electronic service is stored in the smart card, so the step 103 is executed. If the passenger then uses the smart card to access the on-line service that charges by time periods after getting on the bus and swiping the card, then the number of pieces of second service information corresponding to unfinished electronic services that are stored in the smart card becomes two and the step 105 is executed.

Step 103: matching the received related information of the electronic service with the second service information found in the step 102. If they don't match each other, then the step 105 is executed; and otherwise, the step 104 is executed.

Here, this may be accomplished by matching the service instruction of the received first service information with the service instruction of the only one piece of second service information determined in the step 102, or by matching the instruction identification of the received first service information with the instruction identification of the only one piece of second service information determined in the step 102.

For example, the stored only one piece of second service information corresponding to a unfinished relevant electronic service includes: a get-on instruction and a time of 8:00. Then, When the received service instruction of the first electronic service is a recharging instruction, the two electronic services are not correlated and the step 105 is executed. When the received service instruction of the first electronic service is a get-off instruction and the service instruction of the stored second service information is a get-on instruction, the two service instructions are therefore strictly

correlated, then the step 104 is executed.

When the received service instruction of the first electronic service is an on-line service that charges by time periods and the only one service instruction of the relevant electronic service stored in the smart card is a get-on instruction, the two service instructions are therefore not correlated and the step 105 is executed. However, at this point, the number of pieces of second service information corresponding to the unfinished relevant electronic services stored in the smart card becomes two.

Step 104: updating the log file according to each piece of first service information stored in the cache file.

Here, because only one piece of second service information corresponding to the unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second service information, the log file can be updated according to each piece of first service information stored in the cache file and on the basis of the first-in-first-out (FIFO) principle.

When a service identification has been created in the cache file for each piece of stored first service information according to the time at which the first service information is stored, each service identification may be searched according to a storing time sequence and the first service information corresponding to the service identification that is found can be determined. Then, the determined first service information will be used as the last piece of service information in the log file.

Of course, in an embodiment of the present invention, before the log file is updated, according to each piece of first service information stored in the cache file, the first electronic service obtained may be firstly executed and the corresponding first service information be stored into the cache file after the first electronic service is executed, and then the log file is updated according to each piece of first service information stored in the cache file. Alternatively, the first electronic service is executed and the corresponding first service information is stored into the log file after the first electronic service is executed, and then the log file is updated according to each piece of first service information stored in the cache file, and finally, the pieces of service information stored in the log file are adjusted according to the time.

The first service information stored in the cache file must be invalidated after the log file is updated; in other words, each piece of first service information stored in the cache file must be invalidated so that these pieces of first service information will not be involved in the next updating process. Here, this may be accomplished by deleting each piece of first service information stored in the cache file, or by attaching a corresponding invalidating mark to each piece of first service information stored in the cache file, or, by deleting the corresponding service identification of each piece of first service information that has been created in the cache file.

Step 105: executing the first electronic service, storing the corresponding first service information into the cache file after the first electronic service is executed, and returning to the step 101 to receive related information of a next first electronic service.

Here, executing the received first electronic service comprises: obtaining the first service information corresponding to the received first electronic service according to the received related information of the first electronic service and the last piece of the first service information stored in the cache file. Wherein, a service balance amount may be calculated according to the received related information of the first electronic service and the service balance amount of the last piece of first service information stored in the cache file, and then the new balance amount is obtained and the new balance amount is incorporated into the received related information of the first electronic service to obtain the corresponding first service information after the first electronic service is executed.

Then the obtained corresponding first service information is stored into the cache file. Here, a service identification may be created for the stored first service information in the cache file according to an sequence of storing time of the first service information.

Before this step is executed, the last piece of first service information stored in the cache file includes: a get-on instruction or a get-on instruction identification, a balance amount of the smart card of 10 Yuan, a stop No. of the current stop which is No. 13, a date, a time, a PSAM No., a serial No. of the card reader, etc.

If the first electronic service received in the step 101 is a recharging service which is unrelated to all the second service information stored in the smart card, then the

recharging service is executed to recharge the smart card. Here, the balance amount of the smart card becomes $100+10=110$ Yuan after 100 Yuan is recharged into the smart card, so the corresponding first service information includes: a recharging instruction, a balance amount of the smart card which is 110 Yuan, a service amount of 100 Yuan, and a time of 8:20 a.m. This first service information is stored into the cache file. At this point, the last piece of first service information stored in the cache file includes: a recharging instruction, a balance amount of the smart card which is 110 Yuan, a service amount of 100 Yuan, and a time of 8:20 a.m.

A service identification is created for the recharging service according to an sequence of storing time. After the recharging service is stored in the cache file and the service identification is created for the recharging service, a latest piece of first service information which includes the following is further stored in the cache file: an expenditure instruction, a balance amount of the smart card which is $110-60=50$ Yuan, a service amount of 60 Yuan, and a time of 8:30 a.m. Because the expenditure service is stored into the cache file after the recharging service, the service identification created for the expenditure service is also arranged after the service identification of the recharging service.

The correspondence relationships between the first service and the service identification stored in the cache file are shown in Table 1 below:

First service information	Service identification
Get-on service information (original)	
Recharging service information (newly stored)	1
Expenditure service information (newly stored)	2

Table 1

In the aforesaid step 105, the security authority of the service instruction or the instruction identification in the related information of the first electronic service must be

checked when the first electronic service obtained is executed, and only when the service instruction or the instruction identification received satisfies the security authority, can the corresponding first electronic service be executed.

Of course, in embodiments of the present invention, the log file may consist of one, two or more files, and the cache file may also consist of one, two or more files. Wherein the received related information of a electronic service may be stored into one log file, and corresponding service information may be stored into another log file after the electronic service is executed.

In embodiments of the present invention, only when only one piece of second service information corresponding to a unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second service information, will the log file be updated; and in all other cases, the received first electronic service is executed directly and the corresponding first service information is stored into the cache file after the first electronic service is executed.

Hereinbelow, embodiments of the present invention will be further detailed with reference to the attached drawings.

Embodiment 1: A passenger uses a smart card to take a bus that charges by trip sections, and the smart card has a balance amount of 3 Yuan. When the passenger gets on the bus, only the charge of 2 Yuan for the full trip of the bus is recorded, and the charge is to be deducted when the passenger gets off the bus and the charge for the current trip of the passenger is 0.5 Yuan. When riding on the bus, the passenger air recharges 100 Yuan into the smart card through the wireless network and expends 60 Yuan on shopping online.

The smart card stores only one piece of service information corresponding to an unfinished relevant service when the passenger gets on the bus (i.e., the service information corresponding to the get-on service). Wherein the service information comprises: a get-on instruction, a balance amount of 3 Yuan, a full-trip transit charge which is marked as 2 Yuan, a stop No. of the current stop which is No. 1, a time of 7:00 a.m., a boarding trade authentication code (TAC), a serial No. of the card reader, etc.

Referring to Fig. 2, the electronic service processing process is described as

follows.

Step 201: receiving related information of the recharging service.

Here, a recharging instruction for the smart card is received in a Wi-Fi wireless manner. The recharging amount is 100 Yuan and the time is 7:10 a.m.

Step 202: determining that only one piece of second service information corresponding to an unfinished relevant electronic service is stored in the smart card (i.e., the service information corresponding to the get-on service). Then, step 203 is executed.

Step 203: determining that the recharging instruction and the get-on instruction do not match each other correlatively. Then, step 204 is executed.

Step 204: checking a security authority of the recharging instruction. If the recharging instruction satisfies the security authority, then step 205 is executed. Otherwise, a piece of error information is returned to the recharging server in a Wi-Fi wireless manner, which indicates that the recharging service cannot be executed for the smart card; and then the process ends the current service processing procedure and proceeds to a next service processing procedure which, in this embodiment, can be step 207.

Step 205: recharging the smart card and storing the corresponding service information into the cache file after the recharging service is executed.

After 100 Yuan is recharged into the smart card, the service information includes: the recharging instruction, a balance amount of the smart card which is $3+100=103$, a service amount of 100, a time of 7:10 a.m., a recharging TAC, etc. The service information is stored into the cache file.

Step 206: setting a service identification for the corresponding service information stored in the cache file according to the sequence of storing time after the recharging service is executed, and returning to the server a status word and a result indicating that the recharging operation is successful in a Wi-Fi wireless manner.

Here, the service identification of the corresponding service information may be set to be 1 after the recharging service is executed.

Step 207: receiving related information of the expenditure service.

The passenger expends 60 Yuan on shopping online. Therefore, an expenditure instruction, an expenditure amount of 60 Yuan, a time of 7:20 a.m., and an expenditure TAC, etc. are received.

Step 208: determining that only one piece of second service information corresponding to an unfinished relevant electronic service is stored in the smart card (i.e., the service information corresponding to the get-on service). Then, step 209 is executed.

Step 209: determining that the expenditure instruction and the get-on instruction don't match each other correlatively. Then, step 210 is executed.

Step 210: checking the security authority of the expenditure instruction. If the expenditure instruction satisfies the security authority, then step 211 is executed. Otherwise, a piece of error information is returned to the online expenditure server, which indicates that the expenditure service cannot be executed for the smart card; and then the process ends the current service processing procedure and proceeds to a next service processing procedure which, in this embodiment, can be step 213.

Step 211: the smart card executing the expenditure instruction, and storing the corresponding service information into the cache file after the expenditure instruction is executed.

After 60 Yuan is expended on shopping, the service information in the cache file includes: the expenditure instruction, a balance amount of the smart card which is $103-60=43$, a service amount of 60, a time of 7:20 a.m., an expenditure TAC, etc.

Step 212: setting a service identification for the corresponding service information stored in the cache file according to the sequence of storing time after the expenditure service is executed, and returning to the online expenditure server a status word and a result indicating that the expenditure service is successful in a Wi-Fi wireless manner.

Here, the service identification of the corresponding service information may be set to be 2 after the expenditure service is executed.

Step 213: receiving related information of the get-off service.

At 7:40 a.m., the passenger gets off the bus at the stop No. 10. The get-off instruction, the stop No. of the current stop which is No. 10, the time of 7:40 a.m., the

TAC, the serial No. of the card reader, etc. can be obtained by swiping the smart card.

Step 214: determining that only one piece of second service information corresponding to an unfinished relevant electronic service is stored in the smart card (i.e., the service information corresponding to the get-on service). Then, step 215 is executed.

Step 215: determining that the get-off instruction and the get-on instruction that are received match each other correlatively (i.e., are correlated electronic services). Then, step 216 is executed.

Step 216: checking the security authority of the get-off instruction. If the get-off instruction satisfies the security authority, then step 217 is executed; and otherwise, a piece of error information is returned to the background server and the process ends.

Step 217: executing the get-off service, and storing the corresponding service information into the cache file after the get-off service is executed.

When the passenger gets off the bus at the stop No. 10, the charge for the current trip is 0.5 Yuan. Therefore, after the get-off service is executed, the service information includes: the get-off instruction, a balance amount of the smart card which is $43 - 0.5 = 42.5$ Yuan, a service amount of 0.5 Yuan, a time of 7:40 a.m., the TAC, a serial No. of the card reader machine, etc. The service information is stored into the cache file.

Step 218: setting a service identification for the corresponding service information stored in the cache file according to the sequence of storing time after the get-off service is executed, and returning to the server a status word and a result indicating that the get-off service is successful in a Wi-Fi wireless manner.

Here, the service identification of the corresponding service information may be set to be 3 after the get-off service is executed.

Step 219: searching for the service identifications 1, 2 and 3 from the cache file, and updating the log file according to each piece of first service information stored inside the cache file and on the basis of the FIFO principle.

The service identification that is firstly stored in the cache file is "1", and the service information corresponding thereto is the recharging service information, which includes:

the recharging instruction, the service balance amount of 103 Yuan, the service amount of 100, the time of 7:10 a.m., the recharging TAC No., etc. Therefore, this piece of service information will be used as the last piece of service information in the log file, and then the last piece of service information in the updated log file includes: the recharging instruction, the balance amount of the smart card which is 103 Yuan, the service amount of 100, the time of 7:10 a.m., the recharging TAC No., etc.

The cache file also comprises the service identification "2", and the service information in the cache file includes: the expenditure instruction, the service balance amount of 43, the service amount of 60, the time of 7:20 a.m., the expenditure TAC No., etc. This piece of service information will be used as the last piece of service information in the log file, and then the last piece of service information in the updated log file includes: the expenditure instruction, the balance amount of the smart card which is 43 Yuan, the service amount of 60 Yuan, the time of 7:20 a.m., the expenditure TAC No. or the like.

The cache file further comprises the service identification "3", and the service information in the cache file includes: the get-off instruction, the balance amount of the smart card which is 42.5 Yuan, the service amount of 0.5 Yuan, the time of 7:40 a.m., the TAC, the serial No. of the card reader, etc. This piece of service information will be used as the last piece of service information in the log file, and then the last piece of service information in the updated log file includes: the get-off instruction, the balance amount of the smart card which is $43-0.5=42.5$ Yuan, the service amount of 0.5 Yuan, the time of 7:40 a.m., the TAC, the serial No. of the card reader, etc.

Step 220: deleting the service identifications from the cache file, i.e., deleting "1", "2" and "3" altogether.

Here, execution of the electronic services, updating of the log file and deletion of the service identifications are all accomplished according to a power-off protection mechanism in this embodiment.

The balance amounts in the log file and in the cache file in Embodiment I are shown in Table 2 below:

Electronic service instruction	Balance amount corresponding to the last piece of service information in the log file	Balance amount corresponding to the last piece of service information in the cache file	Service amount
Get-on instruction	3 (identification-2)	3	
Recharging instruction	3 (identification-2)	$3+100=103$	100
Expenditure instruction	3 (identification-2)	$103-60=43$	60
Get-off instruction	3	$43-0.5=42.5$	0.5
1 st updating	$3+100=103$	103	100
2 nd updating	$103-60=43$	43	60
3 rd updating	$43-0.5=42.5$	42.5	0.5

Table 2

Embodiment II: A passenger uses a smart card to take a bus that charges by trip sections, and the smart card has a balance amount of 3 Yuan. When the passenger gets on the bus, the charge of 2 Yuan for the full trip of the bus is deducted. Because the charge for the current trip of the passenger is 0.5 Yuan, 1.5 Yuan will be reimbursed when the passenger gets off the bus. Furthermore, when riding on the bus, the passenger air recharges 100 Yuan into the smart card through a wireless network and uses the smart card to access the on-line service that charges by time periods.

The smart card stores only one piece of service information corresponding to an unfinished relevant service when the passenger gets on the bus and swipes the smart card (i.e., the service information corresponding to the get-on service). Wherein the service information comprises: a get-on instruction, a balance amount of $3-2=1$ Yuan, a service amount of 2 Yuan, a stop No. of the current stop which is 1, a time of 7:00 a.m., a boarding TAC, a serial No. of the card reader, etc.

Referring to Fig. 3, the electronic service processing process is described as

follows.

Step 301: receiving related information of the recharging service.

Here, a recharging instruction for the smart card is received in a Wi-Fi wireless manner. The recharging amount is 100 Yuan and the time is 7:10 a.m.

Step 302: determining that only one piece of second service information corresponding to an unfinished relevant electronic service is stored in the smart card (i.e., the service information corresponding to the get-on service). Then, step 303 is executed.

Step 303: determining that the recharging instruction and the get-on instruction do not correlatively match each other. Then, step 304 is executed.

Step 304: checking a security authority of the recharging instruction. If the recharging instruction satisfies a security authority, then step 305 is executed. Otherwise, a piece of error information is returned to the recharging server in a Wi-Fi wireless manner, which indicates that the recharging service cannot be executed for the smart card; and then the process ends the current service processing procedure and proceeds to a next service processing procedure which, in this embodiment, can be step 307.

Step 305: recharging the smart card and storing the corresponding service information into the cache file after the recharging service is executed.

After 100 Yuan is recharged into the smart card, the service information includes: the recharging instruction, a balance amount of the smart card which is $1+100=101$, a service amount of 100 Yuan, a time of 7:10 a.m., a recharging TAC, etc. The service information is stored into the cache file.

Step 306: setting a service identification for the corresponding service information stored in the cache file according to the sequence of storing time after the recharging service is executed, and returning a status word and a result indicating that the recharging operation is successful in a Wi-Fi wireless manner.

Here, the service identification of the corresponding service information may be set to be 1 after the recharging service is executed.

Step 307: receiving related information of the on-line service that charges by time

periods.

The on-line service that charges by time periods is conducted. Therefore, an on-line instruction, a time of 7:20 a.m., an on-line TAC, etc. are received.

Step 308: determining that only one piece of second service information corresponding to an unfinished relevant electronic service is stored in the smart card (i.e., the service information corresponding to the get-on service). Then, step 309 is executed.

Step 309: determining that the on-line instruction and the get-on instruction don't match each other correlatively. Then, step 310 is executed.

Step 310: checking the security authority of the on-line instruction. If the on-line instruction satisfies the security authority, then step 309 is executed. Otherwise, a piece of error information is returned to the network server, which indicates that the on-line service cannot be executed for the smart card; and then the process ends the current service processing procedure and proceeds to a next service processing procedure which, in this embodiment, can be step 313.

Step 311: the smart card executing the on-line instruction, and storing the corresponding service information into the cache file after the on-line instruction is executed.

After the on-line service is executed, the service information in the cache file includes: the on-line instruction, a balance amount of the smart card which is 101 Yuan, an on-line time of 7:20 a.m., an on-line TAC, etc.

At this point, two pieces of service information corresponding to unfinished relevant services are stored in the smart card, which comprise: the get-on service information and the on-line service information.

Step 312: setting a service identification for the corresponding service information stored in the cache file according to the sequence of storing time after the on-line service is executed, and returning a status word and a result indicating that the on-line service is successful.

Here, the service identification of the corresponding service information may be set to be 2 after the on-line service is executed.

Step 313: receiving related information of the off-line service that charges by time periods.

The off-line service that charges by time periods is conducted. Therefore, an off-line instruction, a time of 7:30 a.m., an off-line TAC, etc. are received.

Step 314: determining that two pieces of second service information corresponding to unfinished relevant electronic services are stored in the smart card (i.e., the get-on service information and the on-line service information). Then, step 315 is executed.

Step 315: checking the security authority of the off-line instruction. If the off-line instruction satisfies the security authority, then step 316 is executed; and otherwise, a piece of error information is returned to the network server, which indicates that the off-line service cannot be executed for the smart card; and then the process ends the current service processing procedure and proceeds to a next service processing procedure which, in this embodiment, can be step 318.

Step 316: the smart card executing the off-line service, and storing the corresponding service information into the cache file after the off-line service is executed.

The charge for the current on-line service is 10 Yuan, so after the off-line service is executed, the service information in the cache file includes: the off-line instruction, a balance amount of the smart card which is $101-10=91$, a service amount of 10, an off-line time which is marked as 7:30 a.m., an off-line TAC, etc.

After the off-line service is executed, again only one piece of service information corresponding to an unfinished relevant service (i.e., the get-on service information) is stored in the smart card.

Step 317: setting a service identification for the corresponding service information stored in the cache file according to the sequence of storing time after the off-line service is executed, and returning a status word and a result indicating that the off-line service is successful.

Here, the service identification of the corresponding service information may be set to be 3 after the off-line service is executed.

Step 318: receiving related information of the get-off service.

At 7:40 a.m., the passenger gets off the bus at the stop No. 10. At this point, the get-off instruction, the stop No. of the current stop which is No. 10, the time of 7:40 a.m., the TAC, the serial No. of the card reader, etc. can be obtained by swiping the smart card.

Step 319: determining that only one piece of second service information corresponding to an unfinished relevant electronic service is stored in the smart card (i.e., the service information corresponding to the get-on service). Then, step 320 is executed.

Step 320: determining that the get-off instruction and the get-on instruction that are received match each other correlatively (i.e., are related electronic services). Then, step 321 is executed.

Step 321: checking the security authority of the get-off instruction. If the get-off instruction satisfies the security authority, then step 322 is executed; and otherwise, a piece of error information is returned to the background server and the process of the current embodiment ends.

Step 322: executing the get-off service, and storing the corresponding service information into the log file after the get-off service is executed.

When the passenger gets off the bus at the stop No. 10, the charge for the current trip is 0.5 Yuan and 1.5 Yuan must be reimbursed. Therefore, after the get-off service is executed, the service information includes: the get-off instruction, a balance amount of the smart card which is $91+1.5=92.5$ Yuan, a service amount of 1.5 Yuan, a time of 7:40 a.m., the TAC, a serial No. of the card reader, etc. The service information is stored into the log file.

Step 323: searching for the service identifications 1, 2 and 3 from the cache file, and updating the log file according to each piece of service information stored in the cache file and on the basis of the FIFO principle.

The service identification that is firstly stored in the cache file is "1", and the service information corresponding thereto is the recharging service information, which includes: the recharging instruction, the service balance amount of 101 Yuan, the service amount of 100 Yuan, the time of 7:10 a.m., the recharging TAC No., etc. Therefore, this piece of

service information will be used as the last piece of service information in the log file, and then the last piece of service information in the updated log file includes: the recharging instruction, the balance amount of the smart card which is 101 Yuan, the service amount of 100 Yuan, the time of 7:10 a.m., the recharging TAC No., etc.

The cache file also comprises the service identification "2", and the service information corresponding thereto in the cache file includes: the on-line instruction, the service balance amount of 101 Yuan, the time of 7:20 a.m., the on-line TAC No., etc. This piece of service information will be used as the last piece of service information in the log file, and then the last piece of service information in the updated log file includes: the on-line instruction, the balance amount of the smart card which is 101, the time of 7:20 a.m., the on-line TAC No., etc.

The cache file further comprises the service identification "3", and the service information corresponding thereto in the cache file includes: the off-line instruction, the service balance amount of 91, the service amount of 10, the time of 7:30 a.m., the off-line TAC, etc. This piece of service information will be used as the last piece of service information in the log file, and then the last piece of service information in the updated log file includes: the off-line instruction, the balance amount of the smart card which is 91, the service amount of 10, the time of 7:30 a.m., the off-line TAC, etc.

Step 324: deleting the service identifications from the cache file, i.e., deleting "1", "2" and "3" altogether.

Step 325: adjusting the sequence of the pieces of service information in the log file according to the recorded time.

After the log file is updated, the get-off service information recorded in the step 322 is adjusted to be the last piece of service information in the log file.

Wherein, execution of the electronic services, updating of the log file and deletion of the service identifications are all accomplished according to a power-off protection mechanism in this embodiment.

Therefore, the balance amounts in the log file and in the cache file in Embodiment II are shown in Table 3 below:

Electronic	service	Balance	amount	Balance	amount	Service
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instruction	corresponding to the last piece of service information in the log file	corresponding to the last piece of service information in the cache file	amount
Get-on instruction	$3-2=1$	1	2
Recharging instruction	1	$100+1=101$	100
On-line instruction	1	101	0
Off-line instruction	1	$101-10=91$	10
Get-off instruction received			
Get-off instruction	$91+1.5=92.5$	91	1.5
1 st updating	$1+100=101$	101	100
2 nd updating	101	101	0
3 rd updating	$101-10=91$	91	10
Adjusting the service information	92.5	92.5	1.5

Table 3

In the aforesaid embodiment II, the smart card has stopped surfing the internet before the passenger gets off the bus .Of course, the smart card can stop surfing the internet after the passenger gets off the bus, and in this case the processing process may include:

After the passenger gets on the bus, related information of the recharging service is received. Then, the recharging service is executed and the corresponding recharging service information is stored into the cache file.

After related information of the on-line service that charges by time periods is received, the on-line service is executed and the corresponding on-line service

information is stored into the cache file. At this point, there are two pieces of service information corresponding to unfinished relevant electronic services in the smart card (i.e., the get-on service information and the on-line service information).

After related information of the get-off service is received, the get-off service is executed immediately and the corresponding get-off service information is stored into the cache file. At this point, there will be only one piece of service information corresponding to an unfinished relevant electronic service in the smart card (i.e., the on-line service information).

After related information of the off-line service is received, the off-line service may be firstly executed and the corresponding off-line service information be stored into the cache file; and then, on the basis of the FIFO principle, the log file is updated according to each piece of service information stored in the cache file. Alternatively, the off-line service may be firstly executed and the corresponding off-line service information be stored into the log file; then on the basis of the FIFO principle, the log file is updated according to each piece of service information stored in the cache file; and finally, the pieces of service information in the log file are adjusted according to the recorded time and, meanwhile, each piece of service information stored in the cache file is made invalidated (i.e., cannot be used in the next updating process).

A device for processing electronic services may be implemented according to the aforesaid method. Referring to Fig. 4, the device comprises a receiving unit 100, a matching unit 200, an updating unit 300 and a cache unit 400.

The receiving unit 100 is configured to receive related information of a first electronic service.

The matching unit 200 is configured to, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored, match the received related information of the received first electronic service with the second service information so as to make sure whether they are related.

The updating unit 300 is configured to, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second

service information, update a log file according to each piece of first service information stored in a cache file.

The cache unit 400 is configured to, when the number of pieces of stored second service information corresponding to unfinished relevant electronic services is not one or, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is unrelated to the second service information, execute the first electronic service and store the corresponding first service information into the cache file after the first electronic service is executed.

The device further comprises: a verifying unit, being configured to check a security authority of a service instruction or a instruction identification of the received related information.

Wherein, the matching unit 100 may comprise: a first matching sub-unit, being configured to match the service instruction of the received related information with the stored service instruction of the second service information.

The matching unit 100 may also comprise: a second matching sub-unit, being configured to match the received instruction identification with the stored instruction identification of the second service information.

In an embodiment of the present invention, the device further comprises a first executing unit. Thus, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received information of the first electronic service is related to the second service information, the first executing unit is configured to execute the first electronic service, and stores the corresponding first service information into the cache file after the first electronic service is executed. Then, the updating unit 300 updates the log file according to each piece of first service information stored in the cache file.

Of course, the device may further comprise a second executing unit. Thus, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second service information, the second executing unit is

configured to execute the received first electronic service, and stores the corresponding first service information into the log file after the first electronic service is executed. Then, the updating unit 300 updates the log file according to each piece of first service information stored in the cache file.

In this embodiment, the device further comprises: an invalidating unit, being configured to invalidate each piece of the first service information stored in the cache file after the log file is updated according to each piece of the first service information stored in the cache file. This can ensure that these pieces of first service information will not be involved in the next updating process.

Wherein the invalidating unit comprises: a first deleting sub-unit, being configured to delete each piece of first service information stored in the cache file.

The invalidating unit may further comprise: a labeling sub-unit, being configured to label a corresponding invalidating mark to each piece of first service information stored in the cache file.

The invalidating unit may further comprise: a second deleting sub-unit, being configured to delete the valid mark corresponding to each piece of first service information stored in the cache file.

The cache unit 400 is further configured to obtain the first service information corresponding to the received first electronic service according to the received related information of the first electronic service and the last piece of first service information stored in the cache file. The cache unit 400 may be further configured to create a corresponding service identification for each of the first service information according to an sequence of storing time.

The updating unit 300 then comprises a searching sub-unit, an updating sub-unit and a deleting sub-unit.

The searching sub-unit is configured to search for the service identification of each piece of the first service information one by one in the cache file according to an sequence of storing time.

The updating sub-unit is configured to determine first service information corresponding to the service identification that is found and to use the determined first

service information as the last piece of service information in the log file.

The deleting sub-unit is configured to delete from the cache file the service identification corresponding to each piece of the first service information.

In practical applications, the device for processing electronic services according to embodiments of the present invention may be a smart card, an electronic key, or other similar devices having a chip with the security processing function.

According to the above descriptions, during the electronic service processing process of the smart card according to embodiments of the present invention, only when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second service information, will the log file be updated according to each piece of first service information stored inside the cache file; and in other cases, the received electronic service is executed directly and the service information corresponding to the electronic service is only stored in the cache file without changing the service information in the log file. This can avoid conflicts between the services, so reading/writing operations on the smart card by a card reader will not be affected and economic loss of the smart card holder or the service provider can be avoided.

Obviously, various modifications and variations of the present invention may be made by those skilled in the art without departing from the spirits and scope of the present invention. Therefore, any such modifications and variations that fall within the scope of claims or equivalents of the present invention shall still be covered by the present invention.

WHAT IS CLAIMED IS:

1. A method for processing electronic services, characterized in that comprising:

when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and received related information of a first electronic service is related to the second service information, updating a log file according to each piece of first service information stored in a cache file; and otherwise,

executing the first electronic service, and storing corresponding first service information into the cache file after the first electronic service is executed.

2. The method of Claim 1, wherein the second service information corresponding to the unfinished relevant electronic service is stored in the log file and/or the cache file.

3. The method of Claim 1, wherein further comprising the following step before updating the log file according to each piece of first service information stored in the cache file:

executing the first electronic service, and storing the corresponding first service information into the cache file after the first electronic service is executed.

4. The method of Claim 1, wherein further comprising the following step before updating the log file according to each piece of first service information stored in the cache file:

executing the first electronic service, and storing the corresponding first service information into the log file after the first electronic service is executed.

5. The method of Claim 1, wherein further comprising the following step after updating the log file according to each piece of first service information stored in the cache file:

invalidating each of the first service information stored in the cache file.

6. The method of Claim 1, wherein the first or the second service information at least comprises one of the following:

a service instruction, an instruction identification, a service amount, a balance amount, a transaction accreditation code (TAC), or a time.

7. The method of any of Claim 1 to Claim 4, wherein further comprising the following step before executing the first electronic service:

checking a security authority of the service instruction or the instruction identification of the related information.

8. The method of Claim 1 or Claim 3, wherein executing the first electronic service comprises:

obtaining the first service information corresponding to the received first electronic service according to the received related information of the first electronic service and the last piece of first service information stored in the cache file.

9. The method of Claim 1 or Claim 3, wherein storing the corresponding first service information into the cache file after the first electronic service is executed comprises:

creating a corresponding service identification for each piece of the first service information according to an sequence of storing time.

10. The method of Claim 9, wherein updating the log file according to each piece of first service information stored in the cache file comprises:

searching for the service identification of each of the first service information one by one in the cache file according to an sequence of storing time;

determining first service information corresponding to the service identification that is found, and using the determined first service information as the last piece of service information in the log file; and

deleting from the cache file the service identification corresponding to each piece of the first service information.

11. A device for processing electronic services, characterized in that comprising:

a receiving unit, being configured to receive related information of a first electronic service;

a matching unit, being configured to, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored, match the received related information of the first electronic service with the second service information so as to make sure whether they are related;

an updating unit, being configured to, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second service

information, update a log file according to each piece of first service information stored in a cache file; and

a cache unit, being configured to, when the number of pieces of stored second service information corresponding to unfinished relevant electronic services is not one or, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is unrelated to the second service information, execute the first electronic service and store the corresponding first service information into the cache file after the first electronic service is executed.

12. The device of Claim 11, wherein further comprising:

a verifying unit, being configured to check a security authority of a service instruction or a instruction identification of the received related information.

13. The device of Claim 11, wherein the matching unit comprises:

a first matching sub-unit, being configured to match the service instruction of the received related information with the stored service instruction of the second service information; or

a second matching sub-unit, being configured to match the instruction identification of the received related information with the stored instruction identification of the second service information.

14. The device of Claim 11, wherein further comprising:

a first executing unit, being configured to, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second service information, executing the received first electronic service, and storing the corresponding first service information into the cache file after the first electronic service is executed; or

a second executing unit, being configured to, when only one piece of second service information corresponding to an unfinished relevant electronic service is stored and the received related information of the first electronic service is related to the second service information, executing the received first electronic service, and storing the corresponding first service information into the log file after the first electronic service is executed.

15. The device of Claim 11, wherein further comprising:

an invalidating unit, being configured to invalidate each piece of the first service information stored in the cache file after the log file is updated according to each piece of the first service information stored in the cache file.

16. The device of Claim 11, wherein:

the cache unit is further configured to obtain the first service information corresponding to the received first electronic service according to the received related information of the first electronic service and the last piece of first service information stored in the cache file.

17. The device of Claim 11, wherein:

the cache unit is further configured to create a corresponding service identification for each piece of the first service information according to an sequence of storing time.

18. The device of Claim 17, wherein the updating unit comprises:

a searching sub-unit, being configured to search for the service identification of each piece of the first service information one by one in the cache file according to an sequence of storing time;

an updating sub-unit, being configured to determine first service information corresponding to the service identification that is found and to use the determined first service information as the last piece of service information in the log file; and

a deleting sub-unit, being configured to delete from the cache file the service identification corresponding to each piece of the first service information.