

A MOBILE PAYMENT SMART CARD AND ITS CONTROL METHOD

【Technical Field】

This invention is involved in a smart card and its control method for mobile payment, and more especially a dual-chip smart card and its control method for mobile payment.

【Background】

Mobile payment is a payment mode by which user can use his/her mobile equipment (usually mobile phones) to pay for goods or service, such as to buy tickets when taking bus or subway, buy tickets at cinema and shop at supermarket or hotel.

Mobile payment has two implementation methods. The first implementation is to directly develop application on hardware platform provided by mobile phones, e.g. NTT DoCoMo NFC mobile phone, in which RF chip for wireless communication and chip for security control are integrated on the main board of mobile phone. Payment application provided by operator is loaded on the mobile phone so as to provide mobile payment service for user. The other

is to integrate with communication smart card with payment function on the mobile phone. As the second mode is more flexible in the integration of payment application and it is unnecessary to bind special mobile phones which decrease the threshold of users, it is preferred by operator.

It is required that the communication smart card with payment function can support RF interface so as to support contactless functions like near field communication while supporting communication function. So it is a typical dual-interface card, which can be applied to communication and contactless payment fields meantime.

Transaction requests from POS (Point Of Sale) or instructions from server via mobile equipment are processed through two different interfaces so as to complete all operations related to payment, such as deduction and charge etc.

Mobile payment smart card usually contains a communication control chip, which can communicate with mobile phone, also can complete communication with POS through wireless connection and then process payment instruction.

Difference from common dual-interface card used in financial field is that communication smart card with payment function

requires functions of contact interface and contactless interface won't interfere each other, and it shall be able to deal with possible data collision between two interfaces.

Contactless communication of mobile payment smart card is mainly implemented by three methods:

- (1) Single Wire Protocol (SWP). The technology requires a NFC chip on the mobile equipment which can communicate with POS wirelessly. Smart card exchanges data with the NFC chip according to SWP Specification. In this way, smart card indirectly implements wireless communication with POS. The communication frequency of NFC chip is 13.56 MHz in accordance with ISO/IEC 14443 A&B Standards.
- (2) 13.56 MHz single-chip dual-interface card. Single-chip dual-interface card uses a common technology. Several smart card manufacturers such as Infineon, NXP and Samsung can supply such chip. Such card has been applied in All-In-One-Card projects of many cities. Its contactless interface supports ISO/IEC 14443 A&B Standards.
- (3) 2.4GHz RF technology. A 2.4GHz communication control chip by means of which RF communication with POS is

implemented is directly integrated on the smart card. The interface complies with enterprise standards, lack of uniform international standards.

Above three technologies have their own advantages. They solve some problems in the implementation of mobile payment, but also have some obvious disadvantages:

- (1) SWP solution conforms to international standards and can be effectively compatible with existing 13.56MHz contactless application. But there are a few terminals supporting SWP at present and no mass produced commercial terminals. User must buy new terminal for payment function, which is the biggest obstacle of such solution.
- (2) At present, user space of 13.56MHz single-chip dual-interface smart card is generally small, but it is necessary to support more than 64K value-added application space in communication field, so mobile payment is difficult to be implemented. Some cases are focused on the implementation of payment function, but give up plentiful communication applications. Besides, the single-chip dual-interface smart card needs mask

development, cycle of which is long and difficult to satisfy rapidly changing user demands on communication application. Because of features of mobile payment, data may be received from contact interface between mobile phone and card and RF wireless interface of smart card at the same time. Single-chip mobile payment card must give up data from RF wireless interface due to limited processing ability so as to ensure the normal function of mobile phone, which affects user's experience sense to a certain extent.

- (3) 2.4GHz RF technology. RF smart card has a 2.4GHz RF chip, so it has some features of RF chip, small size and strong signal with deep penetration. It needn't be supported by special chip in the mobile phones, but is directly used in existing mobile phones. However, as 2.4GHz interface isn't supported by international standards, it is required to do many modifications on the present payment environment, which will make operator invest many costs on the equipments. In addition, lack of international standards also takes uncertain risk. So it is difficult for the technology to get great support from related partners.

As 13.56MHz has the most extensive application foundation, the preferred choice of mobile payment smart card shall be international standards supporting 13.56MHz contactless application. Therefore, how to overcome some disadvantages of 13.56MHz payment smart card solutions, make these solutions compatible with existing 13.56MHz contactless application environment, make sure the high security of financial industry and satisfy changeful mobile communication service requirements will have great influence on the promotion of mobile payment application.

【Contents of invention】

The invention provides a dual-chip mobile payment smart card integrating a chip for communication with chip for mobile payment.

Two chips are integrated on the said mobile payment smart card, master chip for communication ("master chip") and slave chip for mobile payment ("slave chip"). The master chip is a soft-masked chip which can support communication function, access and control the slave chip. The slave chip with frequency 13.56MHz can independently perform contactless payment function, and also can

get data to perform contact function under the control of master chip.

The master chip and slave chip are integrated on the mobile payment smart card through SIP.

The slave chip has contact interface and 13.56MHz contactless interface. It exchanges data with POS via 13.56MHz RF contactless interface. It connects with IO2 of master chip via contact interface IO3 and gets data from peripheral equipments like reader under the control of master chip. Contact interface of slave chip connects with the master chip through ISO 7816-3 protocol. But connection between two chips through other connection protocols shall also be considered as an embodiment of this method.

The master chip controls whether to supply power to slave chip by controlling the switch so as to determine whether to start the contact function of slave chip.

The said master chip contains a communication supporting module for communication and a payment chip access control module.

Whereas, the invention also provides a method to control mobile payment smart card.

The master chip controls the power switch via IO4. When IO4 is in low level state, the power switch is off. When IO4 is in high level state, the power switch is on. Similarly, if a method is used to control the switch in reverse state or a method is used to control the switch based on data from IO4, they shall be also applied to the invention.

A method to control above mobile payment smart card. The method includes the following steps: When peripheral equipments like reader wants to access to the slave chip, it first sends the Slave Chip Selection Instruction to the card. After receiving instruction, the master chip sets the power switch to ON state so that contact function of slave chip is activated. Then the master chip continually receives instructions from peripheral equipments like reader and transparently transfers them to the slave chip. When the master chip receives the Master Chip Selection Instruction, it sets the power switch to OFF state so as to stop the contact interface of slave chip. The control on slave chip by master chip makes slave chip complete some applications like application load and personalization via contact reader, and also makes instructions (financial account query or load) from master chip executed.

When the master chip is switched off, the master chip and slave chip on the mobile payment smart card will work independently. At

that time, the slave chip will work wirelessly via RF coil outside.

When the mentioned master chip controls the slave chip, it makes the switch on and the slave chip will be powered on and changed to contact work mode. Even if it is in contact work mode, the change makes slave chip stably keep in a specific work state.

The 13.56MHz dual-chip mobile payment smart card provided in the invention can be fully compatible with contactless application environment and enlarge application space by integrating soft-mask chip of large-capacity smart card. The soft-masked chip can satisfy the endlessly changed demands, but also can shorten the development time.

【Description of drawings】

Fig.1 is an illustration of dual-chip mobile payment smart card.

Fig.2 is work flow of contact function of slave chip.

Fig.3 is an example of master chip access to slave chip to implement STK account query.

Fig.4 is an example of master chip access to slave chip to implement Load Over The Air.

【Detailed description of embodiments】

In order to make better understanding of the invention, embodiments will be used to describe the invention in detail with drawings.

In order to overcome problems of various mobile payment solutions, the invention provides a mobile payment smart card solution consisting of dual chips with communication and 13.56MHz contactless functions. As shown in fig.1, two chips with different functions are encapsulated on the smart card 100, a master chip M1 and a slave 13.56MHz dual-interface chip M2. The master chip M1 is in charge of communication and able to access and control the slave chip M2. The slave chip M2 is responsible for payment related functions. The master chip M1 and slave chip M2 are integrated on the smart card 100 through SIP (System In a Package).

The slave chip M2 is a common dual-interface payment chip able to be compatible with the mostly popular 13.56MHz contactless application. Mifare function is optional for the M2. The slave chip M2 supports two basic interfaces, contact interface (namely IO3 shown in Fig.1) in compliance with ISO 7186-3 and

13.56MHz contactless interface (namely RF IO shown in Fig.1) in compliance with ISO RF standards, namely ISO 14443A, ISO 15693 and etc.

Smart card 100 connects with mobile phone or other contact reader via interface IO1 of master chip M1, and controls the interface IO3 via interface IO2 of master chip M1. As shown in Fig.2, when reader selects the slave chip M2, the master chip M1 will send all contact instructions from IO1 to the slave chip M2 via IO2. The result after processed by M2 will be returned from IO3 to reader via IO2 first and then via IO1 of M1 so that M2 can complete work in contact environment. The slave chip M2 communicates wirelessly with POS 300 via interface RF IO. Instructions will be processed in M2 and the result will be directly returned by RF IO to POS 300.

Master chip M1 and slave chip M2 are connected via interfaces IO2 and IO3 in accordance with ISO 7816-3. There is a power switch between master chip M1 and slave chip M2. M1 controls whether to supply power to slave chip by controlling the switch so as to determine whether to start the contact function of slave chip.

The master chip M1 not only can select sending external instructions to M2 for processing by the chip selection instruction, but also can directly initiate access to M2 according to functional

demand. As shown in fig.3, take Financial Account Query by STK for example. When user selects Payment Account Query by STK, as payment account information is in the M2, M1 makes the switch S on to make M2 power on and enter to contact function mode. M1 sends Account Query APDU command to M2 via IO2. M2 processes command and returns query result to M1. Then M1 makes the switch S off and displays result on the mobile phone. Fig.4 shows a similar embodiment. When mobile payment function Load Over The Air is executed, M1 gets APDU command by received Load Over The Air to control M2 so as to complete load to payment account.

The above Financial Account Query by STK and Load Over The Air are extended mobile payment functions. Other functional accesses to slave chip by master chip are also the embodiments of the method.

The master chip M1 contains a communication supporting module K1 and payment chip access control module K2. Various supporting modules for communication inside the K1 comply with ETSI standards. K2 is used to make M1 in contact work mode or contactless work mode by controlling switch via IO4.

The slave chip M2 integrated on the smart card 100 above mentioned makes smart card has good compatibility with existing

13.56MHz payment environment and the other chip M1 can satisfy the requirement of large-capacity user space for value-added service. Two chips M1 and M2 work independently or together according to above control methods.

The invention integrates large-capacity soft-mask communication card and 13.56MHz dual-interface payment card. Through the invention, we can get a low-cost mobile payment solution in compliance with communication and financial requirements, which will promote the development of mobile payment industry. In addition to larger value-added application space, the smart card in the invention shortens the development time of mask.

The above mentioned embodiments are just several implementation methods of the invention. They are described in detail, but the detailed description can't be considered as limitation on the scope of the invention. It must be pointed out that common technicians engaged in this field can make some transformations and improvements which belong to the protection scope of the invention. Therefore, the protection scope of the invention shall follow the patent claims.

Claims

1. A mobile payment smart card, including master chip for communication and slave chip for mobile payment. The master chip is used to communicate with peripheral equipments and control the slave chip. The slave chip is used to perform contactless functions and communicate with peripheral equipments under the control of master chip to perform contact functions.
2. A mobile payment smart card as claimed in claim 1, wherein the slave chip has contact and contactless interfaces. The slave chip can connect with wireless POS via contactless interface and connect with master chip via contact interface so as to communicate with peripheral equipments under the control of master chip.
3. A mobile payment smart card as claimed in claim 1 or 2, wherein contact interface of slave chip connects with master chip according to ISO 7816-3.
4. A mobile payment smart card as claimed in one of claims 1-3, wherein there is a power switch between master chip and slave chip. The master chip controls whether to supply power to slave chip by controlling the switch so as to determine whether to start the contact function of slave chip.
5. A mobile payment smart card as claimed in claim 4, wherein the said master chip contains a communication supporting module

for communication and a payment chip access control module. The communication supporting module is used to support mobile communication. The control on power switch is implemented by payment chip access control module.

6. A mobile payment smart card as claimed in one of claims 2-5, wherein frequency of contactless interface is 13.56MHz.
7. A mobile payment smart card as claimed in one of claims 1-6, wherein the master chip is a soft masked chip.
8. A mobile payment smart card as claimed in one of claims 1-7, wherein the master chip and slave chip are integrated on the mobile payment smart card through SIP.
9. A method used to control mobile payment smart card as claimed in one of claims 1-8, wherein it contains the following steps:

When the slave chip is used to perform contactless payment functions, the master chip makes the switch off and stops contact functions to directly perform contactless payment functions.

When contact peripheral equipment wants to access to the slave chip, it will send control instruction to master chip so as to make the switch on. In this way, contact functions of slave chip are activated. Then the master chip receives instructions from contact peripheral equipment and transparently transfers to the slave chip so that contact peripheral equipment can perform

contact functions of slave chip. Or master chip freely determines on and off of switch according to logical function demand so that it can access to slave chip.

10.A method used to control mobile payment smart card as claimed in claim 9 wherein the active access control on slave chip by master chip can implement Financial Account Query by STK and Load Over The Air.