

In-House Electronic Money Design Using Mobile Devices

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Abstract. The Electronic cash that appeared with generalization of IT and the internet has developed into primary resource of electronic commerce and became an important means for growth of global digital economy and national economy. In Korea, T-Money is a the most widely used transportation card that makes use of prepaid and deferred type electronic cash. Integrated T-Money will be launched in 2016 to expand the scope of use. Deferred type T-Money card has recently been converted into mobile payment system and is used nationwide. In this study, an in-house electronic cash system based on mobile payment is designed. In-house electronic cash is a type of electronic cash only used by specific organizations, and smart cards were mostly used in the past. In this paper, electronic cash using smart cards is replaced by electronic cash based on mobile payment that uses smart phones of individual users. Electronic cash based on mobile payment is used as a means of payment for various transactions within an organization. Recharging, payment and settlement of cash are handled within the organization

Keywords: e-Cash, in-house, Mobile payment, Electric-payment

1 Introduction

The advancement in information technology (IT) has become a major trigger for the need of electronic payment method in modern society. Experts expect that the future society would become a so-called cashless society where cash is not required. In particular, IT utilization and e-commerce vitalization in the financial/industrial sector demand transparency and reliability in the use of money, and the expansion of mobile devices needs simplification for this purpose. This trend has accelerated the emergence of electronic money, and already, electronic money for Social Network Service support is being well-received among the young generations. In Korea, electronic money has shown a steady increase in a variety of applications since 2000. The domestic usage of electronic money includes tolls, convenience stores, department stores, subways, and parking lots. In addition, prepaid transportation card T-Money and postpaid card embedded in credit card integrated circuit (IC) chips are widely used. The stability of electronic money, developed and used with digital data,

has become more emphasized. As such, the fact that electronic money is used as a payment method in a virtual area through a network continues to increase the importance and necessity of forming a new business paradigm [1]. This present paper proposes an in-house electronic money that can be used on mobile transactions. The use of in-house electronic money has so far mostly consisted of card-type electronic money. The in-house mobile electronic money proposed in this paper is an electronic money used only within a single organization where the charges, payments, balances, and refunds are performed within the organization. In addition, the vitalization of in-house electronic money within the organization is expected to bring profit to the organization and growth to a new business model in the electronic money market. In this study, the focus is concentrated on the stability of electronic money over anything else, and the design employed the Java Card technology with globally acknowledged stability to allow safe data transfer through mobile devices.

2 Related Studies

2.1 Electronic Money

2.1.1. Overview of Electronic Money: In general, electronic money is used on the concept of parameters of “performing the function of money using an electronic device” [1, 2]. Further, it is defined as “value information expressed by digital signal signed by the bank to guarantee its face value” [1, 3]. Electronic money is defined as “money where a certain monetary value is stored as an electronic signal on an IC chip embedded in a plastic card or a computer communication network, and it can be used in information communication network” [1, 4].

2.1.2. Type of Electronic Money: Electronic money used in Korea can be classified into IC chips, networks, online and offline, open and close, advanced payment, and credit cards [2, 4]. Electronic money with a smartcard IC chip is mostly used in the financial sector [1]. Recently, the spotlight has been focused particularly on T-Money, which is used in the credit card/prepaid card form in connection to PAYCO, a mobile electronic money. T-Money, which is used in the form of a prepaid card, is associated with credit cards and is already universally used.

2.1.3. Utility of Electronic Money: Electronic money that provides monetary value with electronic symbols reduces social cost and is portable and comfortable [1]. The following are the advantages of the electronic money. First, it minimizes the need to possess paper notes. Second, it saves various fees incurred from financial transactions, and the transaction fee can be reduced through direct transaction with the seller. Further, the simplification of the possession of money reduces the risk of theft or loss [5].

2.1.4. Utility of Electronic Money: Led by Moneta, Bankon, and K-Mercc domestic mobile carriers in the 2000s, K-cash, MYbi, Visacash, and similar forms, which are jointly issued by banks, have been in use since 2008. Among such forms, the MYbi transportation card that originated from Busan is one of the biggest success cases. However, MYbi did not grow much larger because of compatibility issues, and it is currently widely in use in connection with the financial sector that centers on T-Money. In 2016, T-Money will become compatible in entire Korea and be nationally used. In addition, domestic mobile electronic money is being changed for availability in simple payment service and expanding the business areas. Currently, the simple payment services in Korea include Kakaopay, UBpay, PayPin, SmilePay, PayNow, KPAY, Yelopay, Mobile T-Money, ApplePay, PAYCO, Samsung Pay, and so on. The PAYCO mobile simple payment, released in May this year, is now growing with a gradual increase in the market share [6].

2.2 Electronic Money Application Technology

2.2.1. Near-Field Communication (NFC): NFC is a short-distance wireless communication standard formed in 2004, which centers on Sony and Nokia. The non-contact protocol for NFC is the international standard ISO/IEC 14443A, 14443B, and FELIC for RF ID and RF IC cards [7].

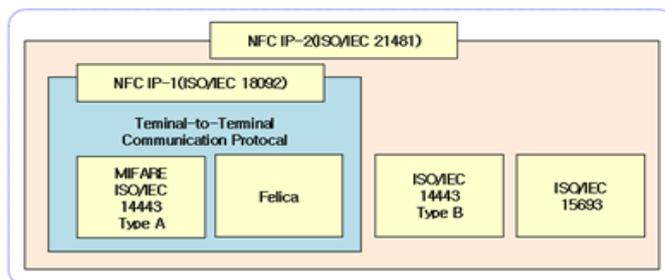


Fig. 1. NFC standard

2.2.2. NFC Operation and Storage Location: The NFC operation supports Card Emulation, Reader/Write, and P2P modes. The Card Emulation mode is the basic operating mode of NFC, which operates in a passive format, making it free from power consumption issue and operates regardless of the state of the terminal. The Reader/Write mode constantly searches a nearby RF IC card during operation in an active format. It requires power, however. The P2P mode is a unique function of the NFC, which operates in an active format. NFC operates a storage location in a Secure Element (SE) to safely store the financial information of an individual. The SE used in the NFC includes USIM, Micro SD, and Embedded SE [7].

3 Design of In-House Electronic Money Using Mobile

3.1 Proposed System Overview

This study designs an NFC-method in-house mobile electronic money, which is categorized charge, payment, and balance. In addition, electronic money possesses the characteristics of commodity money. Therefore, electronic money must not be easily forgeable. The NFC-method in-house mobile electronic money proposed in this paper is only used within an organization. In-house application to electronic money, we use the university campus. University campus canteen, bookstore, cafeteria, school buses, etc. There are a variety of shops. In-house it had been a good model to apply to electronic money.

3.2 The disadvantage of the existing in-house electronic money: University Model Application Standard

Electronic money is available at the existing universities are electronic money smart card scheme. Electronic money smart card system is required to obtain a separate smart card. It is also possible to use a smart card the card shall proceed to issue initial certification process for electronic payments using the university. In addition, the smart card can be reissued inconvenience to attend the Smart Card when a failure occurs and always have the card. This study uses NFC technology is popularized in our lives. Among NFC technology to exchange data between devices within the university it is designed to enable electronic payment usage.

3.3 In-House Electronic Money Design Using Mobile Devices

Fig. 2 shows the service flow of the in-house electronic money using mobile payment, as proposed in this paper.

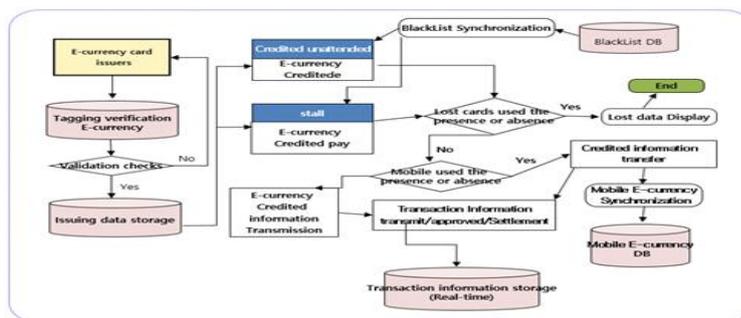


Fig. 2. Proposed System Service Flow

The service flow shown in Fig. 2 is described as follows. ① The user is issued a smart card complete with the authentication of his/her identity for use in mobile payment. ② The issued smart card is charged with money using an unattended charging machine. ③ At this time, the user transacts on the unattended charging machine, e.g., whether perform mobile payment, and charges the mobile electronic money to be used in advance to enable mobile payment. ④ The user who wishes to use the mobile payment downloads the mobile application and completes the identity authentication by entering his/her personal ID and password. The user then confirms the pre-charged mobile payment history. ⑤ Once the charged amount is verified, the user can use the electronic money using mobile methods similar to how smart card-type electronic money is used at a location where a mobile payment device is installed. Further, when the service shown in Fig. 2 is used on a mobile transaction, the NFC tag shall be utilized.

4 Conclusion

The propagation of NFC mobile phones has paved the way to vitalization of mobile payment [8]. In Korea, electronic money has been introduced since the early 2000 and has been used in various applications in which the most successful case is the T-Money. T-Money supports compatibility of devices and financial payment connections, thus making it convenient for its users. The electronic money using mobile payment as proposed in this paper is an in-house electronic money that is used within a specific organization only. The existing in-house electronic money is smart card-based; thus, the user must carry the card-type electronic money at all times to use it. In addition, the user can enjoy increased convenience and simplicity in terms of mobility. Accordingly, this proposed system requires the design of an in-house mobile electronic money using NFC on a personal smartphone, which is able to provide user convenience and simplicity in mobility. Further, because the in-house electronic money is used within a specific organization only, the income from fees can provide profit to the organization. To independently operate this proposed system within an organization, however, initial costs must be incurred, which might be a point of consideration for a small- or medium-sized organization. Therefore, if a large-scale operator can create a package for an in-house electronic money system and supplies it to these small- or medium-sized organizations, it could be employed as an instrument to generate profit.

References

1. Hyun Joo Kim, Soo Jong Lee, In Chul Shin.: Design and Implementation of In-House Electronic Money Using Java Cards, *International Journal of Smart Home*, Vol.7, No. 5, pp. 103-114. (2013)

2. Kim yong gab,: A Study on the Current Use and popularization of e-money, Dan-kook University, pp. 3, 6-13. (2004)
3. Y.J.Song,: Domestic and International Trends and Prospects of e-money, Institute of Electronics Engineers of Korea, pp. 20. (2008)
4. H.S.Hong,: A Study on the Current Use and the Direction for Electronic Cash in Korea, Dan-kook University, pp. 3. (2005)
5. Gi-Hong Kim,: The Current Situation of IC-card type electronic money and its corresponding policy directions, The e-Business Studies, pp. 164-169. (2008)
6. T.M.Kim, BetaNews co, <http://www.betanews.net/article/614822>, (2015)
7. S.H.Jang, J.H.Lee, K.Y.Sung, J.M.OH,: M-Payment: Everything in the Mobile Payments, Cloud9, pp. 132-143. (2014)
8. J.Y.Choi, S.B.Han,: Mobile 3.0 and NFC-based e- business models, The e-business Studies, Vol. 12. No.3, pp. 267-292. (2011)