

## Design of Mobile Application Service of e-Business Card and NFC

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### Abstract

*Today, all of the computing resources, environments of computing, and online application services have been moved to a computing environment based on mobile. In the future, especially mobile phone, can be strong device not only support computing but being closely related to personal privacy. In this article, we design some ideas for various application services using e-Business card and NFC (Near-Field Communications) on mobile environment. Hereafter, new paradigms of mobile cloud and SmartWorks are based on the various mobile application services.*

**Keywords:** *e-Business Card, Mobile Application Service, NFC*

### 1. Introduction

The existing computing environments are developing into a new paradigm of computing that convert devices based on mobile - ubiquitous computing, cloud computing, and mobile environment, etc. Especially, Mobile environment is a concept that means not 'fixed' but 'mobile(movable)' environment, more specifically, it means the hardware, software, network and service environment related to in-car devices, laptop, mobile phone, PDA (Personal Digital Assistant). The term "cloud computing" is being bandied about a lot these days, mainly in the context of the "future of the web." But cloud computing's potential doesn't begin and end with the personal computer's transformation into a thin client - the mobile platform is going to be heavily impacted by this technology as well. Mobile cloud computing refers to an infrastructure where both the data storage and the data processing happen outside of the mobile device. Today, there are already some good examples of mobile cloud computing applications including mobile Gmail, Google Maps, and some navigation apps. However, the majority of applications still do most of the data storage and processing on the mobile devices themselves and not in the cloud. In a few years, that could be changed. Hereafter, we predict ages of the mobile cloud computing and the SmartWork. These new paradigms are based on the various mobile services. Today, all of computing environments, resources, on-line application services are moving towards computing environment based on mobile. In the future, especially the mobile phone, one of the communication devices, can be a strong device not only supporting computing but being closely related to personal privacy. We try to design the various application services by using e-Business card and NFC on mobile environment.

## 2. Related Work

The smart-phone that both Samsung Electronics and LG Electronics recently rolled out, being embedded with business card scanner, can scan the business card, after then management changed it into e-Business card through image and character recognition technology. And now, many e-Business card softwares are being developed based on Android and iPhone. More developed, various types of e-Business card are followed to electronic business-card [1] of MS's outlook, Poken [2] of social network, and vCard [3]. First, Poken is a social business card being developed by Corp. Poken S. A. in Switzerland. It can transmit other's profile information once connection with each other's doll-shaped devices containing USB, and also manages information using computer. The Korea Wireless Network (www.korwin.co.kr), a firm specialized in mobile service providers, developed a protocol stack (brand name: KorwinSTACK), which was supporting Bluetooth spec version 1.1, and implemented the application system for e-Business card (brand name: vCard++) by using it. Through this e-Business card system, business man will be able to exchange their photos, corporate logos, personal information by using mobile phone and PDA with Bluetooth in the future, instead of exchanging paper business card. Also, it is expected to be comfortable with exchanging own information not only to the business man but also to the others.

### 2.1. Process flowchart of business card

As pre-study, we analyze the model of CamCard App in iPhone as shown in Figure 1 and Figure 2. Figure 1 shows data processing and character recognition of CamCars App using picture and scanning of paper business card. Figure 2 presents data classification of insert, update, delete, and abort in database of CamCard App after character recognition in Figure 1.

### 2.2. NFC service of objects

NFC (Near-Field Communications) promises to create a whole new paradigm for the vast majority of cell phone users and is emerging as a near-term reality. It has been described that the confluence of RFID (Radio Frequency IDentification) and cellular telephony will bring with it a wealth of new applications [4]. NFC operates on the same RF principle as proximity cards. There are several advantages of integrating the solution into the cell phone. First obvious advantage is the "Swiss Army knife" approach to centralizing a user's daily life (which also has its drawbacks that must be addressed in the design). Second is that the phone affords a more capable engine than a card for enabling higher-level functions that demand greater memory and processing. Third, and most powerful, is that it provides a backend connection to the cellular network for high-level operations such as real-time loading of funds, security management, and telephone and Internet connections driven by inputs received from NFC interactions [4]. The evolution of NFC is based on an RF, data link, and MAC standard ISO/IEC 18092 [5]. The earlier proximity cards that are used to gain entry to buildings and mass transit in many countries are based on a decade old predecessor, ISO/IEC 14443 [6]. The 106 kb/s passive mode of the NFC standard is compatible with only part A of the predecessor, but since the application space is similar and they use the same RF circuits at the same carrier frequency, they are close enough that multiprotocol NFC front-ends can include operation for all. This is an important so that the phones can emulate transportation and identity cards already in use in very large numbers in part of the world. The multiprotocol operation simply does round-robin sampling for the presence of a response from one of the protocols, a process that occurs in less than a couple of hundred milliseconds. NFC and proximity cards are limited in effective range to just a few centimeters. This distance is sufficient so that you do not have to make contact, but some products are designed to require

a slight touch to activate the link. The method of communication is reactive near-field magnetic coupling at 13.56 MHz, which is a frequency available in all regulatory regions. The wavelength at this frequency is over 22 m, so the use of small loop antennas allows good magnetic coupling at short range while having very poor radiation efficiency. This combination is useful to both keep the communications private and be sure that when you point your wand, there is no ambiguity in your intent [4].

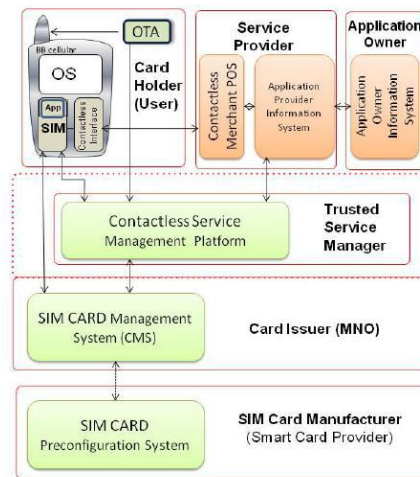


Figure 1. Analysis 1 of CamCard App in iPhone



Figure 2. Analysis 2 of CamCard App in iPhone

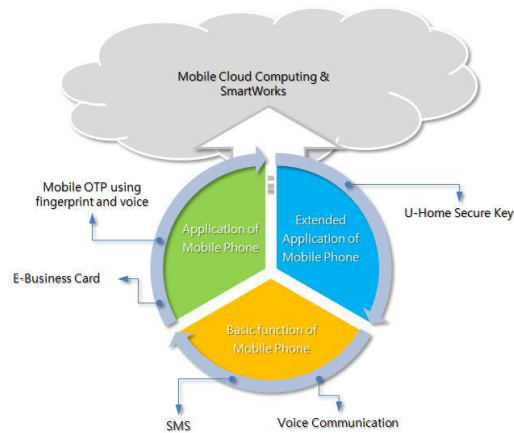
NFC technology is evolving as a key enabler for mobile services. An outgrowth of the contactless card industry, mobile NFC allows the handset to communicate with close-proximity “card readers” allowing point-of-sale payments and/or authorizing the device owner to acquire services, such as access to public transportation. Mobile NFC business models are still being worked out among the stakeholders involved. And Figure 3 presents Mobile NFC Ecosystem [7].



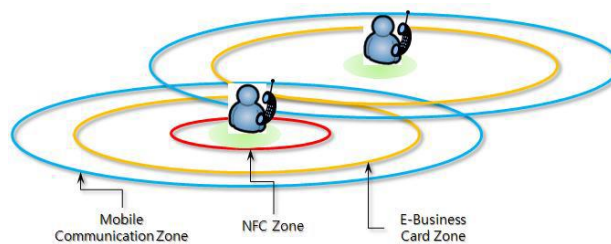
**Figure 3. Mobile NFC Ecosystem**

### 3. Design of E-business Card Application Service

Many people have mobile devices. It is the necessities of modern life. As shown in Figure 4, the services of Mobile phone are divided into basic function, application, and extended application



**Figure 4. Diagram of Mobile Application Services**



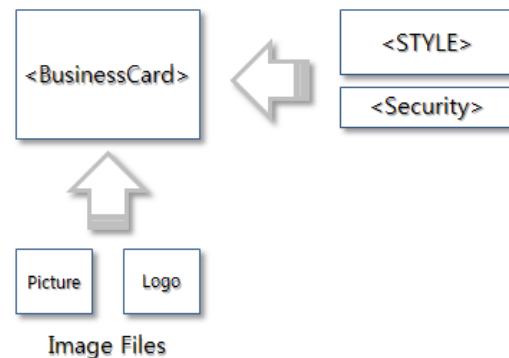
**Figure 5. Service Zones of e-Business Card and NFC**

We will design an e-Business card application service and NFC service of objects in mobile environments. The e-Business card supports information communications among users, stores and things using private communication network of Bluetooth, WiFi, and so on as shown in Figure 5.

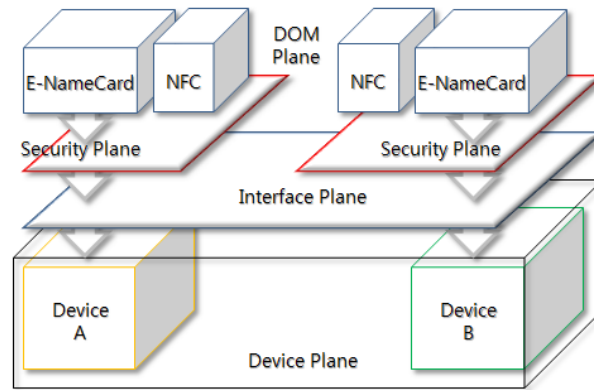
### 3.1. Data structure and access control model of e-business card

The e-Business card contains <BusinessCard>, <STYLE>, <Security> and the image files. The tag of <BusinessCard>, <STYLE>, and <Security> are formed with XML, each express personal information and graphic design on e-Business card as shown in Figure 6. The tag <BusinessCard> has the attributes of name, mobile number, fax number, address, company name, and so on. The tag <STYLE> defines font, color, and so on. And the tag <Security> is the MD (Message Digest) code for the integrity of security.

The access control of NFC and e-Business card mainly consists of four parts: DOM (Document Object Model) Plane, Security Plane, Interface Plane, Device Plane, as follows Figure 7. The access control of DOM Plane runs having logical relation between two cases: it runs in DOM aspect in one case of making and modifying of e-Business card and NFC objects or needing to convert after version upgrade, and in SAX (Simple API for XML) aspect in the other case of composing menu and searching. The access control of Security Plane is logically related with access control and management about the e-Business card on the repository. The e-Business card is managed by the security level of itself (whether including digital certificate or not) and security level based on security policy of the user. The access control of Interface Plane is logically related with the interface between the version upgrade of e-Business card and the device. It supports interface for communication between device and the external to the multichannel. The access control of Device Plane is logically related with physical access about the storage device like USIM or external USB; it is for practical, physical access control.



**Figure 6. Data Structure of the Proposed e-Business Card**

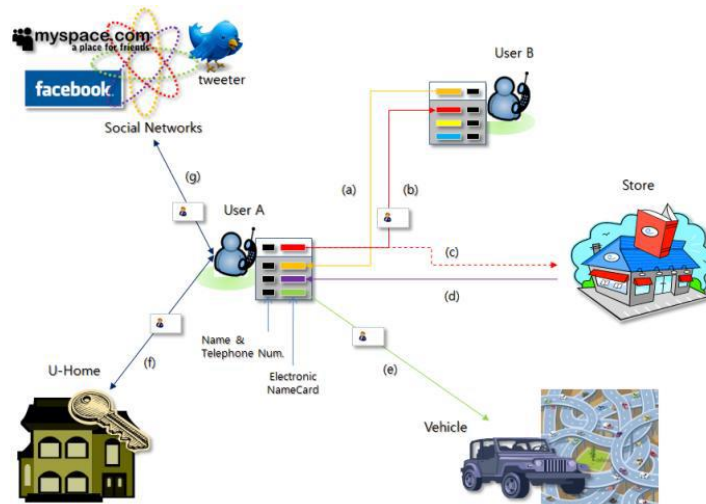


**Figure 7. Access Control Model of e-Business Card and NFC**

#### 4. Application Service of e-business Card

In Figure 8, the application fields of e-Business card based on mobiles are divided into 5 parts [8]:

- Exchanging e-Business card among users,
- Exchanging e-Business card between stores and users,
- Exchanging e-Business card between automobile navigation system,
- Exchanging information between Social Networks,
- Key service of U-home.

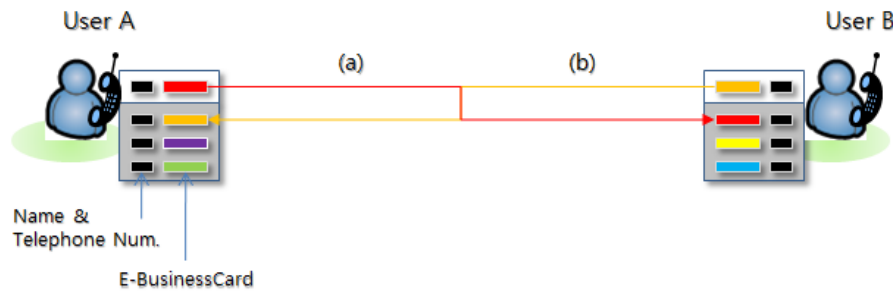


**Figure 8. Extended Application Services of e-Business Card**

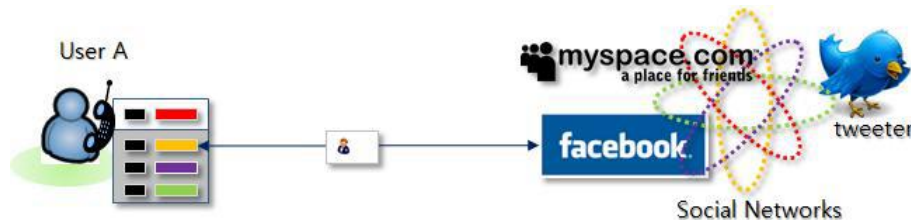
##### 4.1. Management of E-business card between users and social networks

Many modern people are having the mobile device, and especially it becomes a necessity for the business man. The mobile device is performing electronic passport like text messaging, e-Mail, games, memo, scheduler, and so on, developed from just its means of communications. It is possible to exchange e-Business card among the mobile devices via

WiFi or Bluetooth communications rather than traditional method of exchanging the paper business cards among users. The exchanged e-Business card by users and social networks can provide an intelligent searching function, and is managed efficiently by DMS (Database Management System) being embedded with the mobile device as shown in Figure 9 and Figure 10.



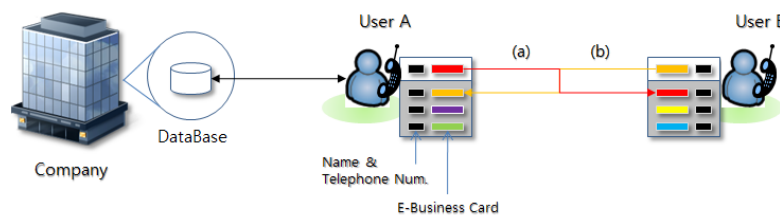
**Figure 9. Exchanging of e-Business Card among users**



**Figure 10. Exchanging of e-Business Card Between User and Social Networks**

#### 4.2. Sales management

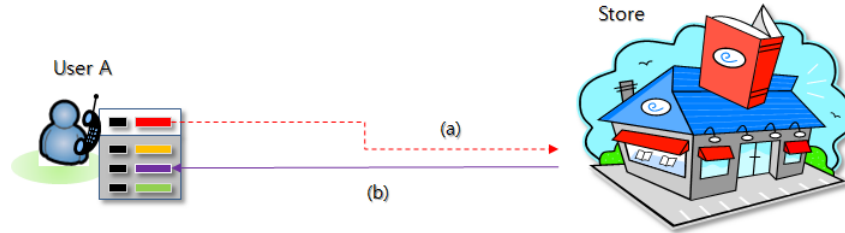
The e-Business card supports the work of collection of data and classification of customer management for business man. Especially, it is usable to search items for supporting enterprise-wide works around customers' profile as shown in Figure 11.



**Figure 11. Management of Customer Profiles Using e-Business Card**

#### 4.3. Role of E-business card at store

It is possible to exchange the e-Business card between mobile devices of its users, and exchange the information about their business at the restaurant or store, as well. The user can provide e-Business card for not all of information for exchanging and searching but only the necessary information because of privacy protection aspect as shown in Figure 12 (dot line).

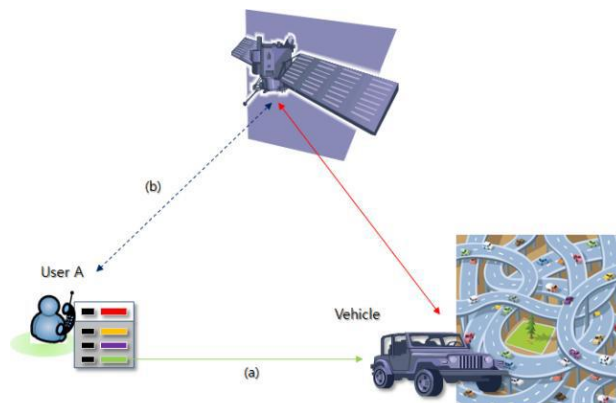


**Figure 12. Transmission and Reception of e-Business Card between Users and Stores**

- **Services of item information and e-coupon on mobile internet environment.** It is able to provide the e-coupon service and search information of menu at restaurant or products sold at store using the information of store and restaurant listed on the e-Business card via mobile internet environment.
- **Privacy policy.** It is possible to set up the function about transmission and reception of e-Business card based on privacy policy and value of information. The service providers want to promote their information and get the customer's information, but the customers may regard this as unwelcomed things because of the privacy problem. So, it is needed to limit transmission of personal information and set up of the reception function.

#### **4.4. The security functions between e-Business card and setting up destination on the navigation in automobile smart system**

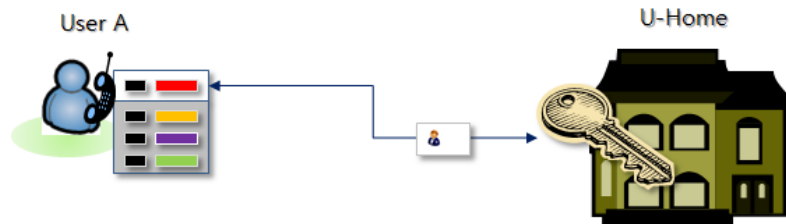
The automobile smart systems are mainly divided into two parts: automobile smart-key and automobile navigation system. It is able to provide the function of automobile smart key adding up the message digest function to the e-Business card. It is possible that the function of automobile smart key supports identification technology of knowledge-base and ownership-base. The opening & shutting function of automobile smart key is based on hash value combining mobile phone number, information of e-Business card, private key, and its used record is remaining. The exchange between automobile navigation system and e-Business card is done for making users convenient by consisting ad hoc network between automobile navigation and mobile device, transmitting the information of destination rather than inputting search contents, searching and choosing. The automobile navigation sets up the destination, searching received information as shown in Figure 13.



**Figure 13. Navigation Setup of e-Business Card**

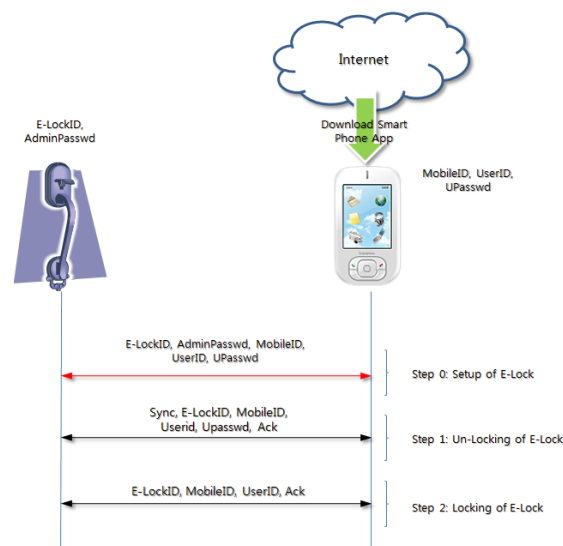
## 5. Secure key function of U-Home

Because Bluetooth and Wi-Fi have longer range connections, it is necessary to enter information to isolate and protect your own communications from others in the application area. And there is no way to indicate intent without typing it in. By touching two NFC enabled devices (*e.g.*, a mobile device and an electronic door knob) as shown in Figure 14, we can immediately establish a Bluetooth and Wi-Fi connection between them. The intent of wanting the connection is established by the physical touch, and then the high data rate connection takes place. NFC is used as an enabler for a connection that was not previously established. Bluetooth and Wi-Fi already anticipate NFC as a pairing mechanism.



**Figure 14. Secure Key of U-Home by NFC**

The secure key service by NFC is provided adding up the function of message digest to electronic key. Especially, the function of secure key U-Home can support identification and authentication technology of knowledge-base and ownership-base. The opening & shutting function of electronic key is based on hash value combining mobile phone number, information of e-Business card, private key, and used record is remaining in mobile device by NFC. The length of hash key for secure key service is proportional to endurable time against burst attack in secure aspect. The more long the hashed-key, the stronger on secure and it can provide much stronger key to electronic key U-Home, departing from existing electronic key that consist of combination of some numbers. Figure 15 presents the process of secure key setup in downloaded mobile app from Internet. In secure key setup processing, there are the setup of E-Lock, Unlocking of E-Lock, and Locking of E-Lock.



**Figure 15. Process of Secure Key Setup in Mobile App**

## 6. Conclusion

All of the computing resources and environments of computing, and online application services are moving to a computing environment based on mobile. In the future, especially mobile phone, will be a strong device not only supporting computing but being closely related to personal privacy. In this article, we sketch some ideas for various application services by using e-Business card and NFC of objects on mobile environment. Especially, we introduce about the simple data structure and the outline of application service using e-Business card. And, we propose access control model for supporting the security function of e-Business card and NFC.

## References

- [1] <http://office.microsoft.com/ko-kr/outlook-help/HA010068636.aspx>.
- [2] <http://www.poken.com/>.
- [3] <http://en.wikipedia.org/wiki/VCard>.
- [4] Jeffrey Fischer. NFC in cell phones-The new paradigm for an interactive world.
- [5] [http://webstore.iec.ch/preview/info\\_isoiec18092%7Bed1.0%7Den.pdf](http://webstore.iec.ch/preview/info_isoiec18092%7Bed1.0%7Den.pdf).
- [6] [http://en.wikipedia.org/wiki/ISO/IEC\\_14443](http://en.wikipedia.org/wiki/ISO/IEC_14443).
- [7] 3G Americas, "Security and Trust in Mobile Applications", (2008) October.
- [8] S. K. Noh, B. R. Cha, D. Y. Choi, J. -J. Park, G. S. Kim and Y. K. Ji, "Idea Sketch of Application Service of e-Business Card and NFC based on Mobile", UNESST, (2011) December 8-10; Jeju, Korea
- [9] P. C. Newton and L. Arockiam, "An Intelligent Technique to Improve Quality of Service(QoS) in multihomed Mobile Networks", IJAST, vol. 7, (2009), pp. 11-20.
- [10] S. Alshattawi, "Building Mobile Tourist An Intelligent Technique to Improve Quality of Service(QoS) in multihomed Mobile Guide Applications using Different Development Mobile Platforms", IJAST, vol. 54, (2013), pp. 13-22.
- [11] J. Woo, A. Bhagav-Spantzel, A. C. Squicciarini and E. Bertino, "Verification of Receipts from M-Commerce Transactions on NFC Cellular Phones", 10th IEEE Conf. on E-Commerce Technology and the Fifth IEEE Conf. on Enterprise Computing, E-Commerce and E-Services, (2008) July 21-24.
- [12] H. Aziza, "NFC technology in Mobile Phone next-Generation Services", Second Int. Workshop on Near Field Communication, (2010) April 20.
- [13] H. Hu, H. Hu and J. Chen, "A Reliable and Configurable E-commerce Mechanism based on Mobile Agents in Mobile Wireless Environments", IJHIT, vol.1, no. 1, (2008) January, pp. 81-94.
- [14] S. Zhang, J. Chen, H. Zhong, Z. Fang and J. Shi, "Trust Network and Trust Community Clustering based on Shortest Path Analysis for E-commerce", IJUNESST, vol. 5, no. 2, (2012) June, pp. 31- 42.
- [15] T. Ho and R. Chen, "Leveraging NFC and LBS technologies to improve user experiences", 2011 Int. Joint Conference on Service Sciences, (2011), May 25-27.
- [16] Near Field Communication(NFC) Technology and Measurements, White Paper, ROHDE & SCHWARZ, (2011).
- [17] F. Asharif, S. Tamaki, T. Nagado, T. Nagata and M. R. Asharif, "Design of Loop-Shaping and Internal Model Controller for Unstable and Communication Delay System", IJCA, vol. 5, no. 2, (2010), March, pp. 59-70.
- [18] G.-H. Hwang and D.-K. Kang, "Systematic Design of High-Performance Smart Card with HF/UHF Dual-Band RFID Tag", IJSH, vol. 6, no. 2, (2012) April, pp.83-88.
- [19] G. Medvinsky and B. C. Neuman, "NetCash: A design for practical electronic currency on the Internet", ISI/RS-93-413, (1993) November.
- [20] D. Chaum, "Blind signatures for untraceable payments", Advances in Cryptology -Crypto '82, Springer-Verlag, (1983).
- [21] D. Chaum, A. Fiat and M. Naor, "Untraceable electronic cash", In Proceedings on Advances in Cryptology (Santa Barbara, California, United States). S. Goldwasser, Ed. Springer-Verlag New York, New York, NY, (1990).
- [22] B. R. Cha, D. K. Kim, S. M. Park, J. Kim and J. H. Seo, "Concept Design of Micro Payment Model Based on Android NFC to Reinvent Traditional Markets", SCTA 2012, (2012).

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