A Payment & Receipt Business Model in U-Commerce Environment

Kyoung Jun Lee
Kyung Hee University of Business Administration
#1 Hoegi-dong Dongdaemun-Ku, Seoul 130-701, Korea
+82-2-961-0490
klee@khu.ac.kr

Jeong-In Ju
Kyung Hee University of Business Administration
#1 Hoegi-dong Dongdaemun-Ku, Seoul 130-701, Korea
+82-2-961-0490
jji99@khu.ac.kr

Jeong Mu Jeong
Design House
Taigwang Bldg., 162-1, Jangchung-dong 2-ga ,Jung-gu, Seoul 100-855, Korea
+82-2-2262-7164
coolcoom@design.co.kr

ABSTRACT

The key to U-payment is convenience and security in the transfer of financial information. The purpose of this paper is to find a desirable U-payment scheme promoting seamlessness and privacy with a consumer device and peer-based information transactions. We also propose a new business model through digital receipt which is evidence of commercial decision making and transaction. We propose U-PR (Ubiquitous Payment and Receipt) business model and method as a way to make transactions seamless, secure and privacy protected.

Categories and Subject Descriptors

J.1 [Computer Applications]: Administrative Data Processing – Business; H.4.2 [Information Systems Applications]: Types of Systems---decision support

Keywords

U-Commerce, Payment, Seamlessness, Privacy, U-Receipt, U-Coupon, Wireless Ad Hoc Peer to Peer Networking, Incentive Mechanism[1]

1. Introduction

U-Commerce is defined as the commercial interaction among providers, consumers, products, and services, enabled and supported especially by (the real-world) seamless communication of each entity's (digital) information (Lee & Ju 2005). The most unique characteristic of the U-commerce is the seamlessness of the information between heterogeneous devices or network forms. But, seamlessness of digital information has a privacy infringement especially payment. Floerkemeier et al. (2004) proposed a RFID Protocol using "Watchdog Tag" as a way to prevent infringement of privacy. Roussos & Moussouri (2004) suggested that users in the ubiquitous computing environments should have control over their personal information through user focus group interview about MyGrocer and expressed a grave concern about exposing private information to outsiders, especially to a profit-oriented company. Acquisti(2002) explained the economic efficacy of privacy protection technologies and Langheinrich (2001) proposed to set principles of privacy protection and impose responsibility for invisible services as a way to protect privacy in the ubiquitous computing environments. Zugenmaier & Hohl (2003) emphasized the importance of keeping anonymity in the ubiquitous computing environments in order to protect user ID from being exposed to personal information collection. However, payment, more than any other areas, is susceptible to privacy concerns and thus merits special attention.

In general, for the protection of privacy, a user could make commercial transactions using false ID in some way when (s)he finds it necessary or wants it to be so. In the process of searching and comparing goods or haggling price, a buyer could make the deal done without revealing his or her identity at his or her will. Despite such efforts, however, in the final stage of a purchase, the purchasing information is to be stored somewhere out there, resulting in infringement of privacy. For this reason, it turns out that the buyer used false ID for nothing. There is a threat to maintain privacy in a U-Commerce environment because of the seamlessness caused by an increase in computing power device resulting in a systematical management of the information. So, we have to equip a way which is enhanced privacy protection payment method.

In this paper, we will suggest new business model with privacy and enforced seamlessness of the information called U-Payment protocol and Payment which is using a receipt, an official document of the payment.

2. Suggestions of U-PR Business Model

Privacy protection, a thorny issue of the ubiquitous computing environments, is a critical element in the architecture of U-Payment method from the initial stage. Reflecting these factors, we propose U-PR business model.

2.1 Scenario

Leon finishes a dinner at a restaurant called 'Arirang' on weekend with his girlfriend. Quite satisfied with the wonderful mood, Leon steps toward the cashier. The service name and price shows up on the monitor of the cashier and Leon has his UDA(Ubiquitous Digital Assistant) read the payment information on the cashier.

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The payment application runs on Leon' device and Leon confirms the payment through an authentication process. After a few seconds, the confirmation message mentioning money sent from Leon's account appears on Leon's device and the clerk also checks payee device showing transaction records.

After the payment, the payee device at the restaurant sends digital receipt to Leon's device. On the receipt Leon received, there was a list of dishes, prices, restaurant, map, etc and basic financial information. Then, Leon sees digital receipt (called U-Receipt) membership sign-up agreement page on the device. The owner of the store told Leon that if he signed up for the U-Receipt, he can deliver digital coupon to other acquaintances and also can gather mileages. Leon thinks that is not harm so agreed and the Leon's personal information for the membership is sent to payee device.

On Monday morning at work, Leon is chatting with his colleague Celline. While talking about the place called 'Arirang' that Leon went on last weekend, Leon recommends the place to Celline. Celline asked for the location. Leon sends the digital receipt by converting into digital coupon to Celline through Bluetooth networking and there are the location of the restaurant and 10 percent discount coupon in a form of U-Coupon. When Celline goes to 'Arirang', she could get 10 percent discount because of the U-Coupon. Leon receives 3 percent of Celline's dinner as an incentive by mileage.

2.2 Elements, Entities, and Architecture

There are three kinds of elements related to the U-PR(Ubiquitous Payment and Receipt) business model as follows.

1) The payer device for gathering, processing, and storing the payment-related Information: In U-PR, the payment-related information is read in from the payee device to the payer-device. A part of the transaction ID(payer_TID) is generated by the payer device and it is integrated with another partial transaction ID generated by the payee device. The integrated transaction ID(TID) became an equal, mutual and unique Transaction ID. The user authentication and payment are also processed by an application which runs on the payer device. Therefore, the payer device is the main element among the U-PR business model and possesses the largest amount of payment-related Information.

2) Payee device for generating the initial payment-related information through the input of the service ID or the product tag and generating a partial Transaction ID of the Payee(payee_TID): After payment, a receipt information is generated to be transported to the payer device through the approval process of the Transaction ID.

3) Payer account and Payee account: The actual payment process is carried out between the two accounts. The accounts exchange the minimal amount of transaction information and do not monopolize payment-related information such as banks and credit card companies.

The payment process creates a new business opportunity by generating and exchanging a digital coupon(U-Coupon) from the digital receipt(U-Receipt) that the payer keeps. From the new business perspective, there are four kinds of economic entities as follows.

1) Payer (Referrer): Purchases products from the stores or uses services. Stores digital receipts on his/her device and sends those to potential customers in a form of U-Coupon.

2) Store: Product or service provider to customers. Payee devices are installed at each store and it confirms payment information, issues digital receipt and checks coupon information.

3) Potential Customer: Receives coupon form the referrer, which is generated from the digital receipt of the referrer.

4) U-Receipt Company: U-Receipt Company is a business leader of the business model and manages servers that stores digital coupon and digital receipt which is a payment information

The Figure 1 shows the system architecture of the U-PR business model and the detail procedure is summarized in Figure 2.

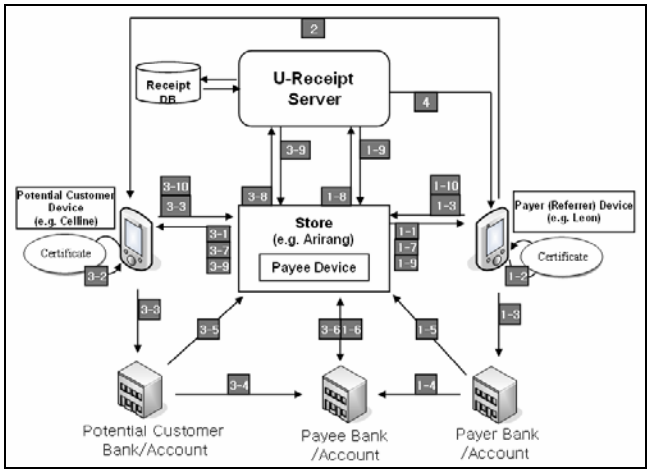

Figure 1. U-Payment and Receipt System Architecture

(0. Receiving a service or buying a product)

Phase 1. Payment

1-1) Payer device recognizes information such as product/service ID, price, encrypted payee ID, encrypted payee account number, and Payee_TID

1-2) Transaction approval of the payer through an authentication process embedded on the device.

1-3) Payer device delivers the integrated transaction ID(TID) to the Payee Device and simultaneously requests payment and the TID to the payer bank

1-4) The price amount is transferred from the payer's account to payee's account.

1-5) Payer bank notifies the transfer to payee device(TID and transfer result)

1-6) Payee bank confirms the receipt of money to Payee device,

1-7) Payee device transmits digital receipt and generate digital receipt TID to Payer.

1-8) Payee device uploads the receipt ID and payer information to U-Receipt server.

1-9) U-Receipt server checks whether the payer is a member or not and if not, asks the payer to sign up.

1-10) Payer signs up for the membership.

Phase 2. Recommendation: Digital coupon Transmission

The Payer (referrer) sends U-Coupon transformed from U-Receipt to potential customer's device

Phase 3. Potential customer: Repeat the Phase 1

(This phase is almost the same as phase 1.)

Phase 4. Provide Incentives

The potential customer uses the coupon that the referrer sent then the referrer receives incentive from the store.

Figure 2. Ubiquitous Payment and Receipt Procedure

2.3 Information Possession of Each Entity

Another feature of the U-PR business model is that it has an information possession structure in which the relevant entities possess the minimal payment information thus maximizing the protection of privacy. Payer device or payee device does not posses the other party's ID information and the payer account and payee account should not possess product list information as in Figure 3.

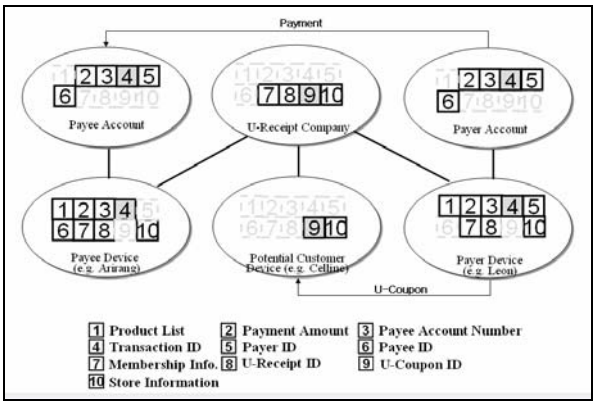

Figure 3. Structure of Payment Information Possession

The essential payment information for the payment process is as follows.

1. Payment Amount: Refers to the price information of a product or service. Refers to the total amount when there are a number of products and service.
2. (Encrypted) Payee Account number: The account number of the payee is the most important payment-related information required in the seamless payment process. This is encrypted and transported to protect the privacy of the payee.
3. Product List: When possessed by a party who is not the payer the individual product name can be a serious threat to privacy. Therefore, this information should be directly possessed by those who are involved in the payment.
4. Payer ID: Information required when confirming the payment of the payees in financial transactions between financial institutions.
5. Payee ID: Information required when confirming the payment of the payer in financial transactions between financial institutions.
6. Transaction ID: The unique Transaction ID of each transaction enables a payment and refund process to be executed using an ID for the relevant transaction without the Payer and Payee having to possess each other's ID. Such Transaction ID combines the information that is independently generated by the Payer and Payee.
7. Membership Information: The basic information of membership in U-Receipt Business (e.g. Name, Cell Phone Number, Address, etc.)
8. U-Receipt ID: The unique digital receipt number
9. U-Coupon ID: The unique digital coupon number
10. Store Information: Business name, telephone number, address, map, owner and more.

The important feature of the Figure 3 is that the payer account and payee account do not possess a product list and the payer and payee also do not possess each other's ID. A financial institution possesses the other party's ID for the transaction of financial information but since it is a third party in the payment process it does not possess information of the product list that might infringe on the privacy of the payer. In the case of buyer and seller, each financial institution that is involved in the payment and payment confirmation process may use a Transaction ID instead of exposing the IDs of the Payer and Payee to outside and prevent the leakage of privacy information such as the IDs of those participating in the transaction.

Also, potential customers only possess U-Coupon information (e.g. Business Name, telephone number, discount rate, etc) without the financial information of the referrer so the privacy of them is protected and U-Receipt company does not own financial information of referrer and potential customers.

Eventually, for the value of 'seamlessness' and protection of privacy to be provided by each payment, each entity should exist in a form in which the minimum payment information essential for payment is categorized. The overall U-Payment architecture should be designed so that the payer account and payee account do not possess the product list and the payer and payee do not posses the other party's ID. Furthermore, for this to be possible, Transaction ID orientation is recommended rather than a Payer ID oriented payment.

3. Analysis of the Business Model

The scenario in the section 2 is on the customer's perspective and described in the focus of customer experience only to be understood by customers (Carroll & Rosson 1995). What is more, we could find out from the system perspective about information moving back and forth between servers, payee devices and user's devices. Now, we will talk about business model from perspective of business entity in detail.

In terms of proposing the business model, we will use representative researches from Timmers (1998), Mahadvan (1999), and Rayport & Jawosky (2001). Timmers recognizes business model from role and benefit of 'business actors', Mahadvan thinks of three 'flows' and Rayport & Jaworski emphasizes

'customer' among the actors. We will try to understand U-PR business model in detail from various perspectives based on these three definitions.

Timmers (1998) defines business model as 1) An architecture for the product, service and information flows, including a description of the various business actors and their roles, 2) A description of the potential benefits for the various business actors, 3) A description of the sources of revenues. Applying the definition business actors can be classified into four entities; U-Receipt Company, stores, referrer, and potential customers. Each role is as follows. U-Receipt company manages digital receipt and coupon. Stores issue digital receipt and recollect coupons. Referrer recommends to potential customers through viral marketing and issue digital coupon. Potential customers create new purchase and convert themselves into referrer.

The latent benefit that business actors will gain is as follows. U-Receipt company gains advertisement fee. Stores may get increase in revenue, referrer gets reward from incentives and potential customers may get a discount form the coupon. The Table 1 shows the relationship between business entities, roles and potential benefit the each entity would obtain.

Table 1. Who-What Table

Entity	Roles	Providing Value	Incentives
U-Receipt Company (Business leader)	Gather stores, Manage digital receipt/coupon, adjust ad cost, manage incentives	Provide advantages of viral marketing	Ads profit
Stores	Appropriate ad cost, Issue U-Receipt, Recollect U-Coupon	Economic benefit to business actors	Increased revenue
Referrer	Issue U-Coupon	Attribute to commerce activation	Possibility of economic incentives
Potential customer	Purchase by recommendation,	Attribute to commerce activation	Coupon discount

Mahadevan(1999) defined business model: unique blend of three streams critical to business. In the U-PR business model, value stream is about delivering U-Coupon that was U-Receipt to potential customer. A referrer sends potential customer to U-coupon and then the potential customer gets the discount by the coupon. Finally the referrer obtains the incentive. Revenue stream is about sponsor paying the advertisement cost to the U-Receipt Company, Referrer paying the store, potential customer paying the store, and U-Receipt Company paying the incentives to the referrer. Last of all, logistical stream is about providing product/service to the referrer or potential customers.

Rayport & Jaworski(2001) defined business model as 1) Value proposition or cluster for targeted customers, 2) Marketspace offering (product, service & information), 3) Unique, defendable resource system, 4) Financial model. Applying Rayport & Jaworski's definition, the target customers of U-Receipt Company are stores that are willing to advertise. Mainly, for example, restaurant, hair shop, clothes shop are advantageous for viral marketing. The specification of the target is that people in their 20s or younger who do not have difficulties using digital receipt. The value proposition that U-Receipt Company will suggest is that revenue increase through viral marketing, from stores to referrer as an incentive, and discount to potential customer. The marketspace offerings to realize the proposed value include service that promotes the exchange of the digital information such as applications that support issuing the digital receipt. The unique and defendable resource system can be structured by network effect and that is obtaining the first mover advantage in the market with U-Receipt business item. Finally, financial model can be analyzed by advertisement costs.

4. Evaluation

In this chapter, we will evaluate U-PR business model. First of all, we will compare our payment model to other payment methods, and then our receipt model to existing receipt/coupon model.

4.1 Comparison with Other Payment Method

U-PR was designed to enhance seamlessness and protection of privacy in Ubiquitous commerce environment. The comparison of U-PR with other payment methods such as cash payment, credit card, and mobile payment will show how much the U-PR enhances the protection of privacy while improving seamlessness. The dimension of evaluation includes seamlessness, privacy, architecture, and PIB (Personal Information Base). We refine the seamlessness dimension into the two elements: transmission of payment information and generation of hyperlink. In addition, we refine the privacy dimension to five elements: information centralization, buyer identification, seller identification, product (service) information, and privacy protection mechanism.

Firstly, U-PR is in the higher level of seamlessness than cash payment, credit card, and mobile payment because U-PR assumes the mobile device can read information about product or service from the product itself or environment.

Secondly, in terms of information centralization, cash is very low as it does not save any information on the payer. Information centralization in mobile payment is high because the credit card company and the mobile Telco may save all of the payment information for later bill. There can be also information revelation in factors such as buyer identification, seller identification as the same reason. Meanwhile, U-PR saves minimum information of payer, payee, and bank.

Cash payment does include neither buyer identification nor seller identification. Cash payment does not involve saving product or service information and uses the receipt that the payer holds, which may create anonymities. In the case of mobile payments, the company keeps records of such transactions. U-PR does not hold any records of product/service information. In addition, privacy protection mechanism does not exist within cash or mobile payments, while U-PR's TID (Transaction ID) and PIB have the mechanism, making it much more dependable for privacy. So comparing with the other payment methods, U-PR maintains high seamless and guarantees enhanced privacy.

Thirdly, cash payment and U-PR have a peer-to-peer payment mechanism while credit card and m-payment have a client/server architecture saving a large part of commerce and payment information.

Table 2. Comparison with Other Payment Method

		Cash	Credit Card	Mobile Payment	U-PR
Seamlessness	Transmission	Non-existing	Non-existing	Low	High
	Hyperlink	Non-existing	Non-existing	Low	High
Privacy	Information Centralization	Low	High	High	Low
	Buyer Identification	Non-existing	Revealed	Revealed	Protected from Seller
	Seller Identification	Non-existing	Revealed	Revealed	Protected from Buyer
	Product (Service) Information	High Protected	Revealed	Revealed	Protected from financial institution
	Privacy Protection Mechanism	Inherent	Non-existing	Non-existing	Transaction ID, and Personal Information Base
Architecture		P2P Architecture Possible	Client /Server Architecture	Client /Server Architecture	P2P Architecture Possible
PIB (Personal Information Base)		Non-existing	Non-existing	Non-existing	Applicable

The Table 2 shows the differences between U-PR and other payment methods.

Specially, m-Payment need more analysis compared with U-PR because, at a first glance, the two methods look similar. m-Payment is the type of transaction that uses device embedded with credit card chip so the payment method is almost the same as the credit card's. In addition, the payment method of m-Payment and credit card is server-based payment method which stores much private information. Therefore, the most outstanding difference between the credit card and U-PR is the perspective of privacy protection and the possible design of new receipt business model.

U-PR also enables the so called peer-to-peer payment where both the payment systems of payer and payee are integrated within an individual device. It suggests a way of safe transactions between a seller and a buyer whose IDs are not exposed through the use of Transaction ID in the flow process of payment information.

4.2 Comparison with Electronic Receipt

In this section, we will evaluate the relative value of the U-Receipt through comparison with paper and electronic receipt.

Paper and Electronic Receipt

The receipt that most widely common in use is a paper receipt. Paper receipt is for the use of change or refund and if not, discarded. On the other hand, electronic receipt is to cover the inefficiency of the paper receipt and gaining its popularity. For example, it is used as a proof of purchase from the internet E-commerce. Electronic receipt is automatically saved on the server so there is no need to keep the receipt but it is not easy to inspect all the integrated commerce information. Also, as all of the information is restored at the server, there is a possibility for privacy to be infringed. However, U-Receipt can bring the effect of reducing the cost of paper receipt to business entities and supports systemized information restoration resulting in cutting down the commerce information management costs.

Paper Coupon & Electronic Coupon

Coupons also can be distinguished from the paper one to the electronic one. The reason that issuing a coupon is to promote more purchase using discount strategy and more and more people are using it. Most of the people use paper coupon, struggling from collecting and storing. Electronic coupon is provided in a form of event at an e-commerce site, valid during the certain time limit suggested by the membership level or a downloadable from the mobile.

In the case of U-Receipt, it is more information-controllable and convenient to the users compared to paper coupon and the functions of recommending and protecting privacy is enforced compared to electronic coupon. The figure below is a comparison value curve of U-Receipt with paper receipt, electronic receipt, paper coupon, and electronic coupon.

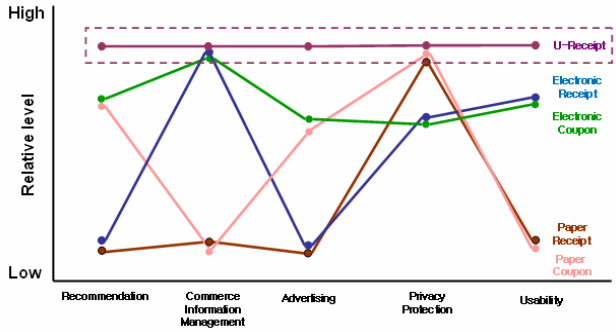

Figure 4. U-Receipt Value Curve

Comparing paper receipt, electronic receipt, paper coupon, and electronic coupon with U-Receipt, paper/electronic receipt does not support recommendation or advertisement and paper/electronic coupon does not aid commerce information management function. Paper receipt and coupon are volatile so personal information is easy to access however, it is difficult to store and manage. Considering every aspect mentioned above, U-Receipt business model proposes relatively overwhelming value.

5. Related Works

Nokia NFC is equipped with smart card chip inside the cellular phone and it is designed to contactlessly transact using 13.56MHz. Representative functions are payment and ticketing (e.g. Parking, Canteen, Bus tickets, Movie tickets, Ski Lift) and designed with Java language application. The similarity between Nokia NFC and U-PR is that both are designed to pay by mobile device and the difference is that Nokia NFC embeds smart card ship in the device that follows the method of credit card type.

Felica, a wallet cellular phone from NTT DoCoMo, is a financial cellular phone service which is quipped with Felica from Sony and provides management of transportation, distribution, and finance related personal information. Moreover, a service that integrates cellular phone and Suica, digital season ticket of JR is performed. The fact that type of transaction is not a type designed for users' privacy protection can be regarded as a difference with U-Payment.

Kourouthanasis et al. (2002), Boddupalli et al. (2003), Seigneur & Jensen (2004) and more studied about payment system. The differences between the existing payment system and the one this study proposes are that the device of user's payment system is always reinforced, that those participants in payment own and control all information and that privacy protection is to a great extent strengthened by the use of Transaction ID and prevention of the exposure of ID.

On the other hand, research of Shojima (2003) is about the process sending the electronic coupon in a P2P type. The similarity with this research is that utilizing P2P networking as a mean to deliver electronic coupon and providing incentives. Nevertheless, the research of Shojima (2003) was concentrated on protecting the records or information about the coupon during the delivery process and suggested to solve the problems related to user's moral hazard (changing the discount rate of the coupon or deleting the valid date) by technological perspective such as using an encryption. The difference with this research is that Shojima only demonstrated coupon delivery method while this paper illustrates the new concept of creating a coupon and also delicate business model.

6. Conclusions

This paper explains U-Payment and U-Receipt business model designed to improve privacy protection while promoting the seamlessness between economic entities. Even more, the U-Payment environment opens a new business opportunity. Through the augmented seamlessness.

To intensify the understanding of this business model, we show scenario, system architecture, business process and models, and the discussion about the evaluation. This business model is an experimental model of U-commerce which is possible in a seamlessness environment and increase of the computing power and this will work as a great medium to connect transaction business model and marketing model.

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