

Applying Mobile Credit Card POS System for Home Delivery Service

Wei-Yu Chen, Chung-Chiang Hu, Shing-Han Li* and Mao-Hsiung Chang

Abstract—Pervasive Internet and the popularity of terminal network devices have provided the opportunities of e-commerce to flourish, promoted the diversified electronic payment mechanism and made the security of electronic payment mechanism attracted much attention. The prevalence of Internet shopping led to the flourish of the home-delivery industry that offers the home-delivery services. For customers and Internet sellers, home-delivery payment becomes a type of reliable payment service. This study analyzes the characteristics and advantages of payment on delivery and mobile payment and explores the feasibility of the mechanism of their combination. Finally, this research uses case studies to understand the benefits of credit card payment on home-delivery and provides the customers, Internet stores, sales drivers a more convenient and the secure goods-delivery and payment mechanism that makes payment transactions more efficient.

Keywords—Home delivery Service, Payment on delivery, Mobile payment, Credit card payment on delivery.

I. Introduction

The advancement of the Internet provides people with convenience in their daily lives, and also helps the fast development of electronic business. With Internet, consumers now can shop online using their credit or ATM cards, without physically attending markets or stores. Online credit card purchasing and online wire transfer become popular ways for people to purchase products or services.

According to statistics, the most chosen ways of payment in online shopping is online credit card payment and the most chosen ways of receiving merchandises is home delivery [1].

Wei-Yu Chen
Department of Information Management, Tatung University
Taiwan.

Chung-Chiang Hu
Department of Information Management, Tatung University
Taiwan.

Shing-Han Li* (Corresponding author)
Department of Information Management, Tatung University
Taiwan.

Mao-Hsiung Chang
Department of Information Management, Tatung University
Taiwan

Home delivery is the key logistics service in the online shopping. It not only supports logistics, but also provides online shoppers with another choice of payment: payment on delivery, which allows consumers to pay as they receive the purchased merchandises. Online credit card payment is realized by transmitting consumers' credit card information to vendors through computers or terminal devices that are connected to the Internet. It has the convenience of avoiding cash transactions and avoiding physical attendance to stores; however, it also brings up the concerns of personal information leak over the Internet. On the other hand, payment on delivery provided by home delivery companies allows consumers pay as they receive the merchandises, reducing the risk of not receiving merchandises after payment and the risk of personal information leak; however, with payment on delivery, consumers must pay with cash and deliverymen carrying a lot of cash often become criminals' targets. To best utilize the advantages of credit card payment and home delivery, this study intends to combine credit card payment with payment on delivery service to form a mobile payment on delivery service for home delivery.

II. Literature Review

A. Online Shopping Payment Mechanism

The development of electronic commerce changes people's ways of shopping. According to Kalalota and Whinston (1997), E-commerce has various definitions when considered from different viewpoints, such as: Communication, Service, Internet, and Business process [1]. According to Segal (1995), online shopping comprises several factors: websites for shopping, products/services for transactions, choices of delivery and pickup, and after-sales services [2]. Peterson, Sridhar and Bart (1997) considered the Internet as a platform to present the functions of traditional sales channels: sales, transaction, and communication [3]. Novak (1998) pointed out that the concept of online shopping was originated from interactive home shopping, in which interactive means that the buyer and the vendor continuously maintain mutual communication [4]. Varshney and Vetter (2002) defined online shopping as that a business provides consumers to order products or services online through the Internet store [5]. Statistics shows that the top 5 payment choices provided by online vendors are ATM transfer, online credit card payment, bank transfer, payment on delivery, and web ATM transfer, as shown in Table I [6].

TABLE I: PAYMENT CHOICES PROVIDED BY ONLINE VENDORS [6]

Payment Choices	Ratio
ATM transfer	90.5%
online credit card payment	83.6%
bank transfer	79.2%
payment on delivery	61.6%
web ATM transfer	55.7%

B. *Mobile Payment Technologies and Applications*

According to Krueger (2001), mobile payment is to pay through mobile communication devices such as cellular phones and PDAs [7]. As the payment facilities are confined in fixed locations with wired communication, mobile payment allows consumers to complete transaction and payment at anywhere through the assistance of mobile devices and wireless communication technologies.

Liang and Wei (2004) pointed out that mobile commerce will become a trend in E-commerce [8]. Wang and Cheung (2004) suggested that mobile commerce applications will be in fast growth and development [9]. Kakihara and Sorensen (2001) pointed out that mobile network has the advantage of anytime and anywhere, compared with wired network [10]. Looney, Jessup and Valacich (2004) mentioned that mobile commerce will be well accepted by businesses with the improvement of technology maturity and standardization, as in the development of the Internet [11]. Coyle (2001) pointed out that mobile commerce has different types of applications ranging from cross-organizational supply chain integration, internal business process, to personal payment service [12].

In the comparative analysis of the services of E-commerce and mobile commerce, Mort and Drennan (2002) pointed out that mobile commerce and service design must satisfy four aspects of consumers' needs: convenience, low cost, scenario matching, and multi-functionality [13]. The analysis of Mort and Drennan (2002) further suggested that convenience is the most influential factor for consumers to choose cellular phones for accessing services [13]. Frolick and Chen (2004) pointed out that the reliability, transmission speed, user interface, and battery capacity are the key challenges that mobile commerce are facing [14]. A mobile credit card reader can satisfy the aforementioned convenience, low cost, scenario matching, and multi-functionality needed in mobile commerce. Chang (2009) categorized credit card readers based on communication connections [15]:

- (1) Fixed credit card reader: using local phones to connect to banks for authorization, suitable for general appointed stores.
- (2) Internet credit card reader: using Ethernet to connect to bank authorization systems located in the appointed stores for authorization, suitable for large wholesale stores and department stores.
- (3) Wireless credit card reader: connected to banks for authorization using GPRS or CDMA wireless connections with SIM cards issued by telecommunication service

providers, suitable for industry sectors with mobile commerce needs, such as home delivery service providers, travel agencies, transportation companies, restaurants, and entertainment businesses.

C. *Home Delivery and Payment on Delivery*

Home delivery is the service to deliver the merchandises, packages, or documents to the receiver's home. Cairns (1996) suggested that there are three basic ways for consumers to order merchandises for with home delivery: (1) phone, fax, or mail order, (2) order from local stores or service locations, and (3) purchasing in local stores for delivery [16]. Typically, vendors make home delivery in two different ways: one is to deliver through self-owned logistics department, and the other is to outsource the delivery to professional logistics companies [17].

Despite of the convenience and low risk of payment on delivery, the current cash collection of payment on delivery has three problems [18]:

- (1) Prone to robbery: Because the cash is collected during delivery, large amount of cash will be carried by delivery persons and temporarily stored in the delivery office, raising the risk of robbery.
- (2) Cash shortage caused by human error: Current payment on delivery requires delivery persons to collect cash from buyers. It is possible to have shortage on the collected cash due to delivery persons' miscount or loss of money.
- (3) Risk of theft by employees: With the seduction of large amount of collected cash, it is possible that employees may steal or illegally use the collected money.

III. Business Process Analysis

A. *Payment on Delivery (Cash Collection) Process Analysis*

In current payment on delivery services, logistics companies provide services from packing and pickup of merchandises at the vendors' sites to home delivery and payment collection on buyers' sites. Figure 1 shows the simplified scheme of home delivery logistics with payment on delivery service. The steps are explained in the following:

- (1) The consumer orders the merchandise on the websites of online stores and selects the payment on delivery service.
- (2) The online store arranges shipping based on the consumer's order and the logistics company picks up the merchandise.
- (3) The delivery person delivers the merchandise to the location designated by the consumer and collects cash for the merchandise and the delivery.

The entire process of home delivery with payment on delivery can be expanded into the process flow chart shown in Figure 2.

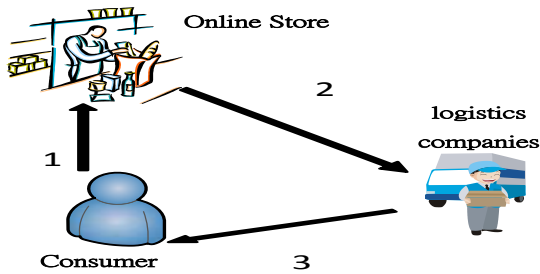


Fig. 1. Home Delivery Logistics with Payment on Delivery Service.

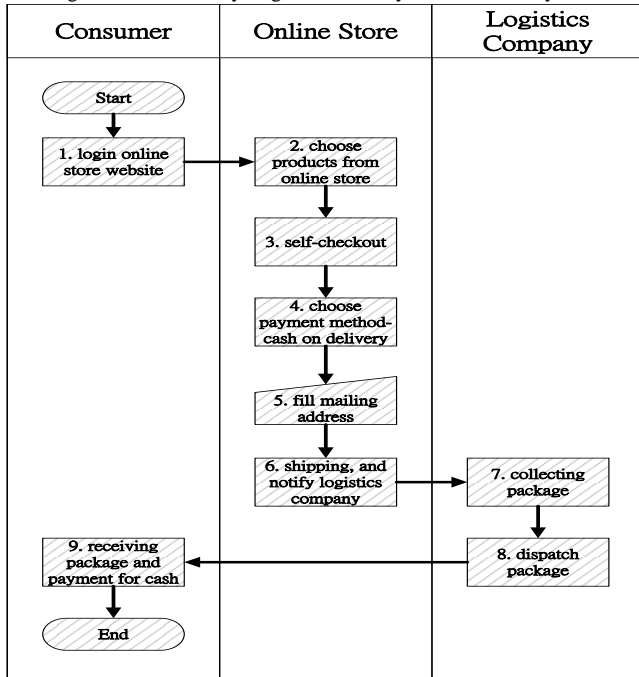


Fig. 2. Process Flow Chart of Home Delivery with Payment on Delivery

B. Mobile Credit Card Transaction Mechanism

A mobile credit card reader allows consumers to use credit card to purchase products or services without having their cards temporarily held by vendors or service providers. Figure 3 shows the simplified mobile credit card transaction process of a physical store.

In current payment on delivery services, logistics companies provide services from packing and pickup of merchandises at the vendors' sites to home

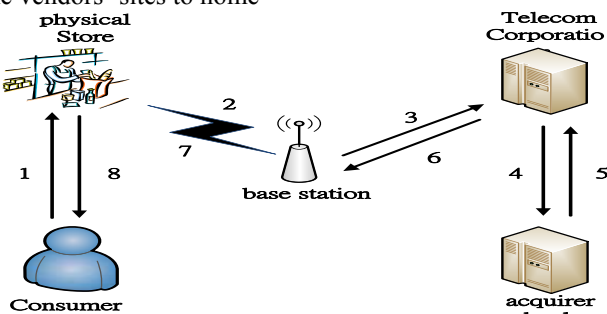


Fig. 3. Simplified Mobile Credit Card Transaction Mechanism.

The simplified mobile credit card transaction mechanism is explained in the following:

- (1) The consumer purchases products or services in a brick-and-mortar store and pays the bill using mobile credit card reader.
- (2) The mobile credit card reader transmits the transaction information through GPRS.
- (3) The base station receives the transmitted inform from the mobile credit card reader and re-transmits the information to the server within the telecommunication service provider.
- (4) The telecommunication server transmits the transaction information to the acquiring bank through a dedicated line.
- (5) The acquiring bank transmits the authorization code to the telecommunication server through a dedicated line.
- (6) The telecommunication service provider transmits the authorization code to the base station.
- (7) The base station transmits the authorization code the mobile credit card reader in the store.
- (8) The mobile credit card receives the authorization code, prints the transaction slip for the consumer to sign.

The entire process flow of mobile credit card transaction process is expanded in Figure 4.

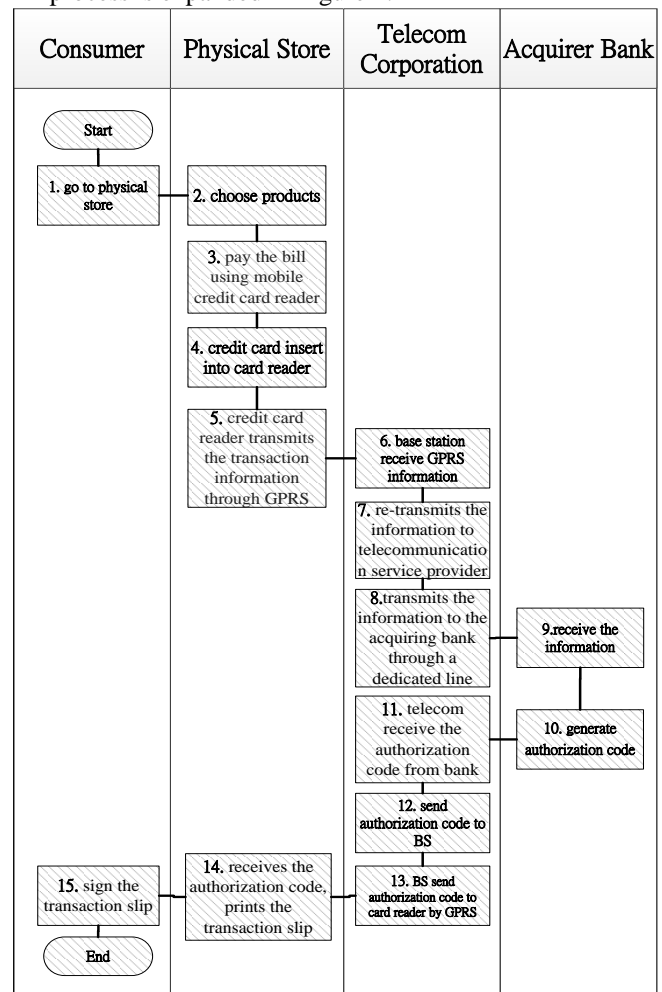


Fig. 4. Mobile Credit Card Transaction Process Flow.

C. The Combination of Payment on Delivery and Mobile Credit Card Payment

The traditional cash payment on delivery has its disadvantage. To address this disadvantage, mobile credit card payment mechanism is employed. Mobile credit card transactions are not limited by locations and can be well-combined with home delivery to provide the credit card payment on delivery service.

The credit card payment on delivery service mode is the combination of the home delivery with payment on delivery service and mobile credit card transaction mechanism, as shown in Figure 5.

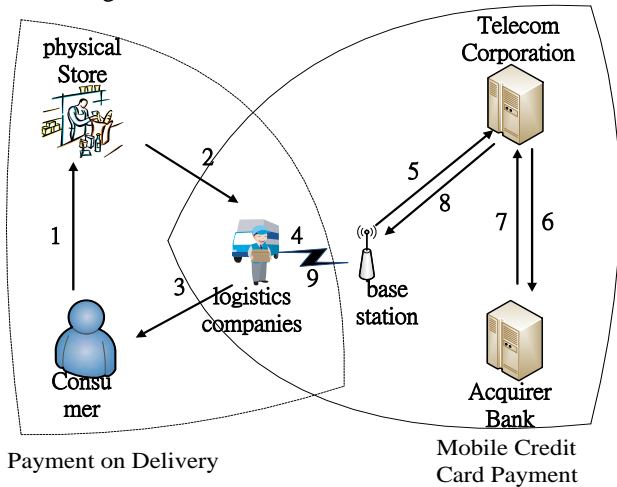


Fig. 5. The Combination of Payment on Delivery and Mobile Credit Card Transaction

The steps of the mobile credit card payment on delivery process are explained in the following. Steps 1 through 3 are the steps for the home delivery with payment on delivery process, while steps 4 through 9 are the mobile credit card transaction mechanism.

- (1) The consumer orders the merchandize in the online or brick-and-mortar store and selects the payment option of payment on delivery.
- (2) The online or brick-and-mortar store packs the ordered merchandise for shipping by the logistics company.
- (3) The delivery person delivers the merchandise to the location designated by the consumer and performs the payment collection through mobile credit card transaction.
- (4) During the mobile credit card transaction, the mobile credit card reader transmits the transaction information to the base station through GPRS wireless communication.
- (5) The base station transmits the transaction information to the telecommunication service provider.
- (6) The telecommunication service provider transmits the transaction information to the acquiring bank for authorization through a dedicated line.
- (7) The acquiring bank issues the authorization code and transmits the code to the telecommunication service provider through a dedicated line.

- (8) The telecommunication service provider transmits the authorization code to the base station.
- (9) The base station transmits the authorization code to the mobile credit card reader for printing the credit card transaction slip and asking the consumer to sign the slip.

The entire process of the combined mobile credit card payment on delivery service is expanded in Figure 6.

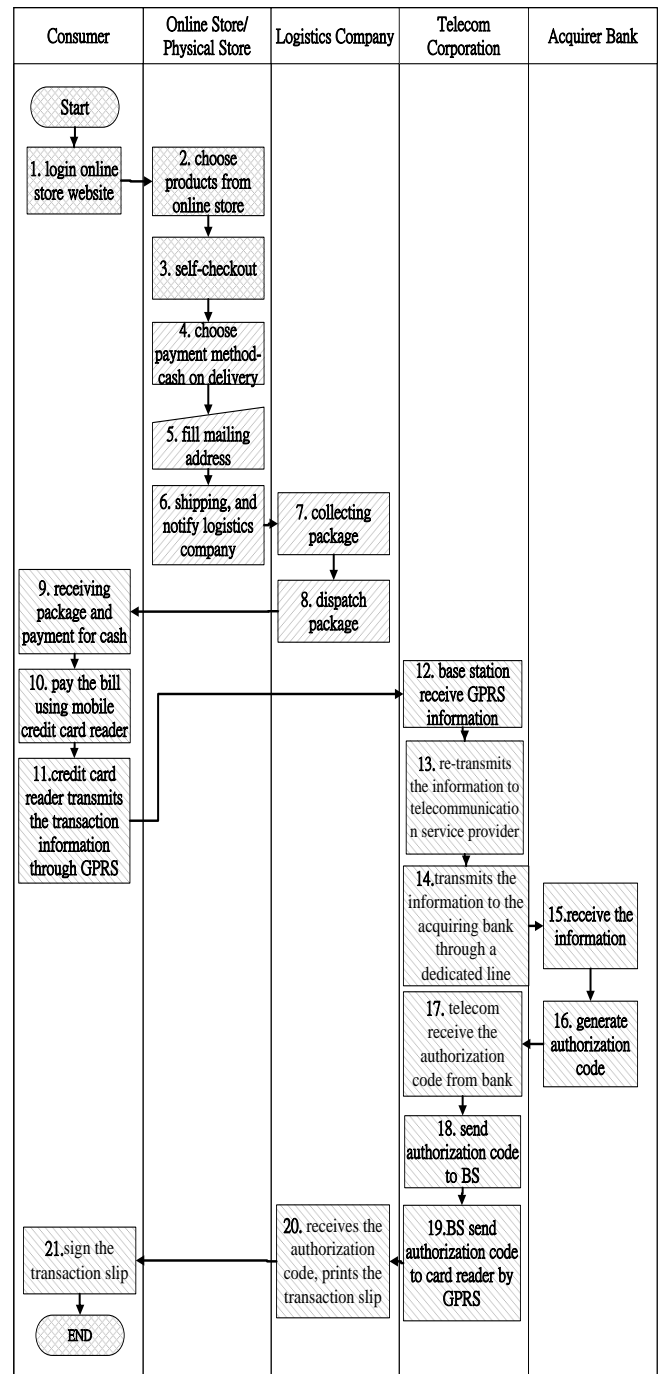


Fig. 6. Combined Mobile Credit Card Payment on Delivery Service Process Flow.

iv. Conclusion

Home delivery with payment on delivery allows consumers to pay as they receive the merchandises. As consumers' concerns about paying before receiving merchandises remains, home delivery with payment on delivery avoid such reliability concerns. This study proposes to combine the mobile credit card transaction with the payment on delivery service and analyzes the combined mechanism through case study implementation. Two contributions of this study have been concluded:

(1) Integration

The combination of the mobile credit card transaction and the payment on delivery service forms a new service which integrates business processes of the vendor, the telecommunication service provider, the acquiring bank, and the logistics company. Such integration provides consumers with more convenience.

(2) Security

The mobile credit card payment on delivery removes the risk of lost, theft or robbery of the collected cash and therefore improves the security. In addition, this study designs the mechanism to detect transaction anomaly, to further ensure the security of credit card transactions.

Effect analysis shows that the number of transactions with mobile credit card payment on delivery is increasing, suggesting the increasing acceptance of the proposed mobile payment mechanism. Analysis also shows the increased transactions are mainly focused in metropolitan areas, suggesting different acceptance levels of urban and suburban areas.

References

- [1] R. Kalakota and A. B. Whinston, *Frontiers of Electronic Commerce*, 1st ed. Boston: Addison-Wesley, 1996.
- [2] R. L. Segal, "The coming electronic commerce (R)evolution," *Strategy & Leadership*, vol. 23, no. 6, Nov./Dec, pp. 21-45, 1995.
- [3] R. Peterson, B. Sridhar, and J. Bart, "Exploring the implications of the internet for consumer marketing," *Journal of Academy of Marketing Science*, vol. 25, no. 4, pp. 329-346, 1997.
- [4] T. P. Novak, D. L. Hoffman, and Y. F. Yung, "Modeling the structure of the flow experience among web users," *INFORMS marketing science and the internet mini-conference*, 1998.
- [5] U. Varshney and R. Vetter, "Mobile commerce: Framework, applications and net-working support," *Mobile Networks and Applications*, vol. 7, pp. 185-198, 2002.
- [6] Department of Commerce, Ministry of Economic Affairs, *2010 Annual Review of E-Commerce*. Taipei: Ministry of Economic Affairs, R.O.C., 2011.
- [7] M. Krueger. (August 2001). The future of m-payments – business options and policy issues, European ePayment Systems Observatory (ePSO), *Institute for Prospective Technological Studies*. [Online]. Available: <http://bookshop.europa.eu/en/the-future-of-m-payments-pbLFNA19934/>
- [8] T. P. Liang and C. P. Wei, "Introduction to the special issue: mobile commerce applications," *International Journal of Electronic Commerce*, vol. 8, no. 3, pp. 7-17, 2004.
- [9] S. Wang and W. Cheung, "E-business adoption by travel agencies: prime candidates for mobile e-business," *International Journal of Electronic Commerce*, vol. 8, no. 3, pp. 43-63, 2004.

- [10] M. Kakihara and C. Sorensen, "Expanding the 'mobility' concept," *ACM SIGGROUP Bulletin*, vol. 22, no.3, pp.33-37, Dec. 2001.
- [11] C. A. Looney, L. M. Jessup, and J. S. Valacich, "Emerging business models for mobile brokerage services," *Communications of the ACM*, vol. 47, no. 6, pp. 71-77, 2004.
- [12] F. P. Coyle, *Wireless Web: A Manager's Guide*, 1st ed. Boston: Addison-Wesley, 2001.
- [13] G. S. Mort and J. Drennan, "Mobile digital technology: emerging issues for marketing," *Journal of Database Marketing & Customer Strategy Management*, vol. 10, no. 1, pp. 9-23, 2002.
- [14] M. N. Frolick, and L. Chen, "Assessing m-commerce opportunities," *Information Systems Management*, vol. 21, no. 2, pp. 53-61, 2004.
- [15] H. C. Chang, "Factors influencing the intention to use of wireless credit card reader – an example in catering industry in Taipei," M.S. thesis, Tatung University, Taiwan, 2009.
- [16] S. Cairns, "Delivering alternatives: success and failures of home delivery services for food shopping," *Transport Policy*, vol. 3, no. 4, pp. 155-176, Oct. 1996.
- [17] K. S. Liu, "Case study on Taiwanese home delivery operation strategy," M. S. thesis, National Dong Hwa University, Taiwan, 2003.
- [18] H. Y. Lin, "Applying mobile credit card readers in payment on delivery services in the home delivery business – An Example of Online Shopping," M.S. thesis, Chang Gung University, Taiwan, 2007.



Wei-Yu Chen is a lecturer in the Department of Computer Science and Information Engineering in Chinese Culture University, Taiwan. He received his master's degree in Information Management from Chinese Culture University, Taiwan in 2005. He is reading doctoral in the Department of Information Management in Tatung University. His research interests include Information Security, Mobile Learning, Mobile Commerce, Image Processing, Network Management, and Digital Archive.



Chung-Chiang Hu is a Ph.D. program student of Department of Computer Science and Engineering in Tatung University, Taiwan. He received his M.S. in the Graduate Institute of Communication Engineering from Tatung University, Taiwan in 2003. His current research interests include Network security, Real-time network device monitoring and Automatic abnormality recovery system and Data Mining.



Shing-Han Li is an associate professor in the Department of Information Management in Tatung University, Taiwan. He received his Ph.D. in information management from National Chung-Cheng University, Taiwan, 2006. His current research interests include Service quality, ERP system, web services and information auditing and assurance. He has published his work in *Journal of Computer Information Systems*, *Journal of Database Management*, *Information Systems Frontiers*, *Information and Software Technology*, *Computers in Human Behavior*, *Computers in Industry*, *Computer Standards & Interfaces*, *Industrial Management & Data Systems*, *Total Quality Management & Business Excellence*, *Production Planning & Control* and *Journal of Medical Systems*.



Mao-Hsiung Chang is currently working for MIS Department of President Collect Service Co., Taiwan. He received her master degree in Information Management from Tatung University in Taiwan in 2012. His research interests include Mobile Credit Card POS System, Mobile payment and Third-Party Payment.