

Comparative Study on Various Methods and types of Mobile Payment System

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Abstract— The mobile payment is the one of the most promising future applications in the domain of mCommerce. Different approaches come to the market and try to address existing needs, but up to day no global solution exists. The proposed system would enhance the P2P (SMS Based) mobile Payment system, which will try to ease the money transfer between two individual. This solution the key difference is the time needed to inform the beneficiary about the completion of the payment. The advantage of such a system is that only the mobile phone number, not the bank account number or credit card details, are transmitted. Moreover, consumers can even request a proposed system's phone number if they do not feel comfortable giving their mobile phone number to merchants. Therefore, proposed system tries to improve the customer's trust and payment security

Keywords— Mobile payment, Mobile Payment Methods, Mobile payment system, business success, P2P SMS Based Mobile Payment.

1. INTRODUCTION

The most of the people in the world use the mobile but all of them do not have the facility to get the internet connection on their mobile, The SMS based mobile payment would be needed to such people in the world.

118 million Europeans, 145 million Asians and 22 million Americans intend to use their mobile phone for paying small purchases, according to research conducted by Tower Group. The study will indicate existing method and type of mobile payment system and how the new system (SMS based mobile payment) can be improved, and what challenges have to be overcome for it to succeed. The conclusions may become useful not only to improve this particular system, but also evaluate chances of success, and if necessary to improve, any new m-payment solution to come. Mobile payments are a natural evolution e-payment schemes that will facilitate mobile commerce. Mobile devices may include mobile phones, PDAs, wireless tablets and any other device that connect to mobile telecommunication network and make it possible for payments to be made.

2. WHAT IS MOBILE PAYMENT?

The Mobile payment systems apply to both how consumers pay for goods, as well as how merchants can process transactions. A common gateway and settlement

agency is required to provide routing between the various mobile payment providers and for the settlement amongst themselves [1].

M-payment (mobile payment) is a point-of-sale payment made through a mobile device, such as a cellular telephone, a Smartphone, or a personal digital assistant (PDA). The mobile phone helps in the exchange of information required for the actual transfer of money [2] [3].

The mobile payment ecosystem consists of member financial institutions, customers, merchants and the various mobile payment service providers. The technology used is proprietary and heterogeneous. The security and transaction flow is approved by financial institutions.

Various definitions exist as regards e-payments and e-banking. According to the Mobile Payment Forum definition [4], "mobile payment is the process of two parties exchanging financial value using a mobile device in return for goods or services".

3. MOBILE PAYMENT STAKEHOLDERS

There are many different stakeholders in the process of implementing mobile payments [3].

- i. Consumers
- ii. Merchants
- iii. Mobile Network operators
- iv. Mobile device manufacturers
- v. Financial institutions and banks
- vi. Software and technology providers
- vii. Government

Each player has different incentives and strategies. Sometimes these interests and strategies between different players may be in conflict e.g., the telecommunications network provider would like to maximize revenues through each m-payment transaction whereas customers and merchants would like to minimize costs for each m-payment transaction.

A mobile payment or m-payment may be defined as any payment where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return for goods

and services [5]. Mobile devices may include mobile phones, PDAs, wireless tablets and any other device that connect to mobile telecommunication network and make it possible for payments to be made [6]. According to a study conducted by Juniper Research, the Global mobile commerce revenues are expected to grow up to 88 billion USD by 2009 [7]. Moreover, the popularity of mobile commerce applications provide new opportunities for mobile users, application developers, service providers, network providers, financial institutions and researchers and make it more profitable and promising.

4. MOBILE PAYMENT CHARACTERISTICS

A mobile payment service in order to become acceptable in the market as a mode of payment the following conditions have to be met [3].

- i. **Simplicity and Usability:** The m-payment application must be user friendly with little or no learning curve to the customer. The customer must also be able to personalize the application to suit his or her convenience.
- ii. **Universality and Interoperability:** M-payments service must provide for transactions between one person to another person (P2P), or from a business to a customer (B2C) or between businesses (B2B). The coverage should include domestic, regional and global environments. Payments must be possible in terms of both low value micro-payments and high value macro-payments. Development should be based on standards and open technologies that allow one implemented system to interact with other systems.
- iii. **Security, Privacy and Trust:** A customer must be able to trust a mobile payment application provider that his or her credit or debit card information may not be misused. Secondly, when these transactions become recorded customer privacy should not be lost in the sense that the credit histories and spending patterns of the customer should not be openly available for public scrutiny. Mobile payments have to be as anonymous as cash transactions. Third, the system should be foolproof, resistant to attacks from hackers and terrorists. This may be provided using public key infrastructure security, biometrics and passwords integrated into the mobile payment solution architectures.
- iv. **Cost, Speed and Cross border payments:** An m-payment solution should compete with other modes of payment in terms of cost and convenience. The speed at which m-payments are executed must be acceptable to customers and merchants. To become widely accepted the m-payment application must be available globally, word-wide.

5. MOBILE PAYMENT TYPES

As per study there are five types of mobile payment.

- i. B2B - Business to Business
- ii. B2C - Business to Consumer
- iii. C2C - Consumer to Consumer
- iv. B2G - Business to Government

v. P2P - Person to Person

I. B2B - Business to Business

B2B e-commerce is simply defined as e-commerce between companies. This is the type of e-commerce that deals with relationships between and among businesses. In the B2B payment universe, there are three types of payment systems: those that replace the traditional role of the bank or finance company, those that work with banks and finance companies to provide a service that banks and finance companies can offer to their own customers, and those that use the ACH system (but not necessarily by offering EBPP) to process payments.

II. B2C - Business to Consumer

B2C e-commerce, or commerce between companies and consumers, involves customers gathering information; purchasing physical goods (i.e., tangibles such as books or consumer products) or information goods (or goods of electronic material or digitized content, such as software, or e-books); and, for information goods, receiving products over an electronic network.

It is the second largest and the earliest form of e-commerce. Its origins can be traced to online retailing (or e-tailing). Thus, the more common B2C business models are the online retailing companies such as Amazon.com, Drugstore.com, Beyond.com, Barnes and Noble and ToysRus. Other B2C examples involving information goods are E-Trade and Travelocity.

III. C2C - Consumer to Consumer

C2C is simply commerce between private individuals or consumers. This type of e-commerce is characterized by the growth of electronic marketplaces and online auctions, particularly in vertical industries where firms/businesses can bid for what they want from among multiple suppliers. It perhaps has the greatest potential for developing new markets.

C2C transactions occur directly between end-customers, across a business platform specifically established to facilitate the exchange. One example that stands out in particular is eBay. The company's payments arm, Paypal, has greatly facilitated C2C e-commerce by holding buyers' money in escrow accounts until the customer confirms receipt of goods, thus removing the risks of non-delivery or of faulty goods. With such a substantial platform to build on, PayPal has also been the leading player globally in C2C m-payments. Locally, however, an increasing number of new players have been springing up in the last few years, but mainly they provide easier payments made over the Internet. These smaller players have yet to enter the m-payment market, but expect that to change in the coming years as the technology becomes more ubiquitous.

IV. B2G - Business to Government

B2G is generally defined as commerce between companies and the public sector. It refers to the use of the Internet for public procurement, licensing procedures, and other government-related operations. This kind of e-commerce has two features: first, the public sector assumes a pilot/leading role in establishing e-commerce; and second, it is assumed that the public sector has the greatest need for making its procurement system more effective.

Web-based purchasing policies increase the transparency of the procurement process (and reduce the risk of irregularities). To date, however, the size of the B2G ecommerce market as a component of total e-commerce is insignificant, as government e-procurement systems remain undeveloped.

V. P2P - Person to Person

P2P m-payments are private transactions between two individuals and are typically SMS-based. This may involve the dissemination of top-up credits (for example transferring minutes or minutes-value in exchange for a good or service), an m-banking transfer of funds, or digital barter such as in the exchange of content or virtual world goods. Thus, commercial platforms may be involved in the transaction, but the transaction is a direct one from one person to another.

Person-to-person (P2P) payments are evolving to the next generation of electronic payments, the mobile channel. Advances in technology have enabled alternative functionalities for mobile handsets beyond the original visions of the designers of handsets or wireless communication architectures to supporting a new and viable channel for mobile financial services, including bill payment and account transfers, domestic and international P2P transfers, proximity payments at the point of sale, and remote payments to purchase goods and services.

Mobile money transfer services are experiencing rapid adoption in many markets, in response to steady growth in remittances, the worldwide ubiquity of cell phones, and the need for an electronic P2P payment alternative to paper-based mechanisms like cash and checks. The growth in mobile telecommunication service availability is expanding the reach of financial services across wireless networks in less developed countries, creating the potential for significant growth in mobile commerce and financial inclusion

6. MOBILE PAYMENT METHODS

The mobile technology landscape provides various possibilities for implementing m-payments. Essentially, a GSM mobile phone may send or receive information (mobile data service) through three possible channels – SMS, USSD or WAP/GPRS. The choice of the channel influences the way m-payment schemes are implemented. Secondly, the m-payment client application may reside on the phone or else it may reside in the subscriber identity module (SIM). We briefly describe NFC technology as another possibility.

I. SMS - Short Message Service

This is a text message service that enables short messages (140-160 characters) that can be transmitted from a mobile phone. Short messages are stored and forwarded by SMS centers. SMS messages have a channel of access to phone different from the voice channel [14]. SMS can be used to provide information about the status of one's account with the bank (informational) or can be used to transmit payment instructions from the phone (transactional).

II. USSD

Unstructured Supplementary Service Data (USSD) is a technology unique to GSM. It is a capability built into the GSM standard for support of transmitting information over the signaling channels of the GSM network. USSD provides session-based communication, enabling a variety of applications. USSD is session oriented transaction-oriented technology while SMS is a store-and-forward technology. Turnaround response times for interactive applications are shorter for USSD than SMS.

III. WAP/GPRS

General Packet Radio Service (GPRS) is a mobile data service available to GSM users. GPRS provides packet-switched data for GSM networks. GPRS enables services such as Wireless Application Protocol (WAP) access, Multimedia Messaging Service (MMS), and for Internet communication services such as email and World Wide Web access in mobile phones.

IV. Phone-based Application (J2ME/BREW)

The client m-payment application can reside on the mobile phone of the customer. This application can be developed in Java (J2ME) for GSM mobile phones and in Binary Runtime Environment for Wireless (BREW) for CDMA mobile phones. Personalization of the phones can be done over the air (OTA).

V. SIM-based Application

The subscriber identity module (SIM) used in GSM mobile phones is a smart card i.e., it is a small chip with processing power (intelligence) and memory. The information in the SIM can be protected using cryptographic algorithms and keys. This makes SIM applications relatively more secure than client applications that reside on the mobile phone. Also, whenever the customer acquires a new handset only the SIM card needs to be moved [12]. If the application is placed on the phone, a new handset has to be personalized again.

VI. Near Field Communication (NFC)

NFC is the fusion of contactless smartcard (RFID) and a mobile phone. The mobile phone can be used as a contactless card. NFC enabled phones can act as RFID tags or readers. This creates opportunity to make innovative applications

especially in ticketing and couponing [13]. The ‘Pay-Buy Mobile’ project launched by the GSM Association (fourteen mobile operators are part of the initiative) targets 900 million mobile users with a common global approach using NFC [12].

VII. Dual Chip

Usually the m-payment application is integrated into the SIM card. Normally, SIM cards are purchased in bulk by telecom companies and then customized for use before sale. If the m-payment application service provider has to write an m-payment application in the SIM card, this has to be done in collaboration with the telecommunications operator (the owner of the SIM). To avoid this, dual chip phones have two slots one for a SIM card (telephony) and another for a payment chip card. Financial institutions prefer this approach as they can exercise full control over the chip and the mobile payment process [3]. But, customers would have to invest in dual chip mobile devices.

VIII. Mobile Wallet

M-payment application software that resides on the mobile phone with details of the customer (and his or her bank account details or credit card information) which allows the customer to make payments using the mobile phone is called as a mobile wallet. Customers can multi-home with several debit or credit payment instruments in a single wallet. Several implementations of wallets that are company-specific are in use globally.

7. GENERIC ARCHITECTURE FOR M-PAYMENTS

This is a simple, illustrative conceptual model that describes the relationship between the major participants in an m-payment scenario (Fig. 1). There is the customer and the merchant who would like to use an m-payment service. The M-Payment Application Service Provider (MASP) provides the necessary technical infrastructure (hardware and software) to facilitate m-payments and acts as an intermediary between the financial institutions and mobile network operators. The MASP registers users who would like to avail of the m-payment service. The users (customers and merchants) have to be registered with the MASP prior to using the service. At the time of registration the MASP collects the bank account details (or credit card details) of the customer and merchant as well as their valid digital certificates. The mobile phone numbers of the customer and the merchant are mapped to their respective bank accounts and this mapping is maintained by the MASP. The users are provided with a client m-payment application (mobile wallet) that is either resident on their phones or else in the SIM card. The mobile wallet will normally interact with the MASP server.

A mobile phone user communicates with a merchant and makes an economic transaction (e.g., buying a ticket from an airline over the phone). The merchant obtains the phone number of the customer and initiates the m-payment transaction request stating the amount for which payment is required. The customer confirms the request and authorizes

payment. The MASP receives the authorization and verifies the authenticity of the customer. The MASP then debits the customer account and credits the merchant account by interacting with the bank. Once the electronic funds transfer is successful a confirmation message is sent to the customer and the merchant advising them of the debit and credit respectively. This model can be extended to handle the interaction between the MASP and the financial system taking into account inter-bank payments and settlement.

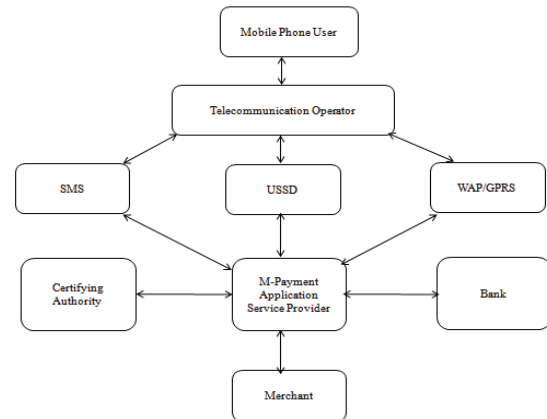


Fig.1. Generic Architecture for M-Payments

8. PAYMENT SYSTEM ADVANTAGE AND DISADVANTAGES

Every payment system has their advantages and disadvantages. In this paper we present a classification of mobile payment systems and methods with their characteristics and mainly focus on P2P payment system.

A. Advantages

- i. Secure connection can be established on most of the mobile browser.
- ii. Secure, end-to-end encryption of SMS and the secure access can be established with the application.
- iii. Stored messages can be accessed without the network connection

B. Disadvantages

- i. Thousands of different combinations for device operating systems, and development environment may prevent support for all devices.
- ii. Differing handset capabilities and performance causes inconsistent user experience when using or downloading the application.
- iii. No ‘off-line’ capabilities, Customer should have the internet connection enable mobile phone if it is not SMS based payment system.

9. PROPOSED ARCHITECTURE AND DESIGN (P2P – SMS BASED)

In the proposed architecture customers can use a mobile device to make the transaction either to individual or for paying any kind of payments/bills. P2P m-payments are private transactions between two individuals and are typically SMS-based. This may involve the dissemination of top-up credits (for example transferring minutes or minutes-value in exchange for a good or service), an m-banking transfer of funds, or digital barter such as in the exchange of content or virtual world goods. Thus, commercial platforms may be involved in the transaction, but the transaction is a direct one from one person to another.

The architecture introduces the Bank shortcode and customer/Beneficiary shortcode which will be stored / managed on the Central Server.

The architecture introduces the Mobile Payment which will be a third-party (external server) who provides an interface between the customer and the Bank. The customer initiates the transaction is called the customer and the person who receives it is called beneficiary. A customer initiates a mobile payment by entering the assigned shotcode of the beneficiary. This information is sent across from the Telecommunication Service Provider to the Mobile Payment Provider which in-turn communicates the same to the customer's bank. After the appropriate processing at the customer's bank, the transaction is sent to the beneficiary's bank. An important step here is to identify the beneficiary's bank. This can be accomplished by storing all the mapping data in a Central server through assigned shortcode. Lots of challenges are to be overcome for a successful implementation of mobile payments to be widely accepted as a mode of payment which would be SMS Based.

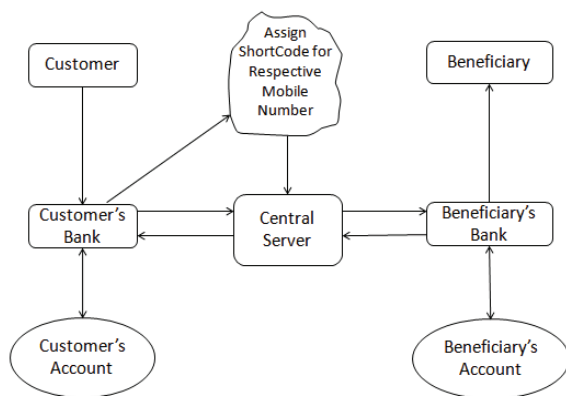


Fig.2. Proposed architecture which will ease the process and will take very less time to transfer money from one individual to another

TABLE 1. Benefits of the proposed architecture

Features	Details
Simple and Convenient	Doing the money transfer through the SMS is very simple, It does not required person to know much about banking software / application
Fast	Architecture simplifies the process by decreasing the number of operations the consumer and employee has go through.
Privacy and security	Architecture simplifies the privacy and security issue while allocating the shortcode to bank and the end user and not transmitting the any other information apart of the shortcode over the network.
Cost	architecture brings the stack holders to single platform and this would reduce the code of end users as well to bank
Universal acceptance	Allows consumers to shop and pay anyone, anywhere, anyhow using mobile payment solutions and underlying wireless networking

CONCLUSION

The paper addresses comparative study on various methods and types of Mobile Payment System. It also discussed on the characteristics of the Mobile Payment system. Lots of challenges are to be overcome for a successful implementation of mobile payments to be widely accepted as a mode of payment which would be SMS Based.

Further research would be required to address some new challenges that have been identified, such as availability of suitable digital content, revenue distribution, and relationship with financial institutions.

This analysis can be used as an example of measuring success factors of any new payment system.

REFERENCES

- [1] Reserve Bank of India, Mobile Banking transactions in India - Operative Guidelines for Banks, Available: <http://www.rbi.org.in/Scripts/> (2008)
- [2] Y. A., Au ,R. J., Kauffman. :The economics of mobile payments: Understanding stakeholder issues for an emerging financial technology application, *Electronic Commerce Research and Applications* (2007)
- [3] S. Karnouskos, F. Fokus. : Mobile Payment: a journey through existing procedures and standardization initiatives, *IEEE Communications Surveys and Tutorials*, pp. 44–66 (2004)
- [4] Mobile Payments Forum, <http://www.mobilepaymentforum.org> (accessed 14.04.07).
- [5] Y.A. Au , R.J. Kauffman.: The economics of mobile payments: Understanding stakeholder issues for an emerging financial technology application, *Journal of Electronic Commerce Research and Applications*, vol. 7, issue 2, pp.141-164 (2008)
- [6] S. Karnouskos , F. Fokus.: Mobile Payment: a journey through existing procedures and standardization initiatives, *IEEE Journal of Communication Surveys and Tutorials*, vol.6, no.4 (2004)
- [7] Juniper Research (2004), Global mCommerce Revenue Projections For 2009, URL:<http://www.epaynews.com/statistics/mcommstats.html>.
- [8] Barkhuus, Louise and Anna Vallgarda. "Saying it All in 160 Characters: Four Classes of SMS Conversations." IT University of Copenhagen, April 2004. http://www1.itu.dk/graphics/ITU-library/Internet/Forskning/Technical_Reports/ITU-TR-2004-45.pdf
- [9] N. Croft and M. Olivier, "Using an approximated One Time Pad to Secure Short Messaging Service (SMS)", In *Proceedings of the Southern African Telecommunication Networks and Applications Conference*. South Africa, 2005
- [10] G. Le Bodic, "Mobile Messaging Technologies and Services SMS, EMS and MMS", 2nd ed., John Wiley & Sons Ltd, (2005).
- [11] J. Li-Chang Lo, J. Bishop and J. Eloff. "SMSec: an end-to-end protocol for secure SMS", *Computers & Security*, 27(5-6):154-167, 2007.
- [12] GSM Association aims for global mobile payments using NFC Card Technology Today, Volume 19, Issue 2, February 2007, Pages 1, 3
- [13] J. Ondrus & Y. Pigneur, (2007). An Assessment of NFC for Future Mobile Payment Systems. *International Conference on the Management of Mobile Business*, 2007, 9-11 July 2007 Page(s):43 - 53 Digital Object Identifier 10.1109/ICMB.2007.9.
- [14] E. Valcourt, J. Robert, & F. Beaulieu, (2005). Investigating mobile payment: supporting technologies, methods, and use. *IEEE International Conference on Wireless And Mobile Computing, Networking And Communications*, (WiMob'2005), Aug. 2005 Page(s):29 - 36 Vol. 4 Digital Object Identifier 10.1109/WIMOB.2005.1512946