

Introducing Speedy Pay: A new mobile payment scheme

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Abstract— We propose a novel scheme that can satisfy all types of payments through mobile phones, fulfill the needs of all stakeholders and still keep a robust relationship between efficiency and security. The proposed scheme is built to achieve high level of security and reliable infrastructure. This will eliminate new expenses, minimize the overheads on all stakeholders and can result in time savings of around 90% in implementation and market. Our proposed system is a new communication network that directly connects banks to their customers through mobile phones. All bank services become readily available anytime and anywhere. Our system enables individuals, point of sale, service provider or any other entity to access their own bank accounts. It relieves users from the need to carry cash or credit cards; they can therefore pay bills, transfer money, receive payments, or make reservations by using their mobile phone in real time.

Index Terms—Mobile payment; M-commerce; M-payment method.

I. INTRODUCTION

Recently, mobile payment has not only a popular trend all over the world, but also the main idea for digital innovation [1]. Mobile payment can be defined as money rendering for any type of service and products through any type of electronic device i.e. (cell phone, smart phone, tab, PDA), and also any payment to friends, institutions and government. Such payment can be domestic or international. By 2017, three billion smart phones are predicted to be in the hands of users worldwide [2]. In fact, the global worldwide m-payment market will reach over 450 million users and transaction value of over US \$ 721 billion by 2017, according to Gartner group forecast [3]. The problem, however, is that many mobile phones are still not connected to the Internet, and for such mobiles to take advantage of mobile payment, technologies such as Interactive Voice Response (IVR), Short Message Service (SMS), and Unstructured Supplementary Service Data (USSD) are required [4].

Our aim is to build new mobile payment network that can facilitate all types of payment through mobile phones, satisfy all stakeholders and keep a robust relation between efficiency and security. Under our proposal, mobile financial services will include firstly mobile payments that involve P2P, C2B and B2B; secondly, microfinance; finally, mobile banking in both directions involving transactions and information. Our proposed system will also have a very efficient and straight-forward integration with other systems. Mobile payment system (MOPS) provides convenient, automated means to handle transactions without the need to use cash, credit cards or any other payment methods. Current

implementations or proposal of MOPS have various drawbacks and limitations, such as:

- They operate with an intermediate/ third party entity. This requires customers to open separate accounts which are different from their normal bank account. Customers need to replenish these accounts either by cash payment or through their credit cards.
- As intermediate entities manage separate customer's account, they are requested to cover transactions monetary value through a bank guarantee.
- They require the enhancement of handset or SIM chip with new functionalities and applications.
- Real Time Person-to-Person (RT P2P) transactions are available between users having account within the same bank only.
- There is no real time payment as it needs lengthy process of money transfer between banks.

For this paper, we propose a novel communication network that will connect banks to each other and to their customers to allow them to make all types of transactions and payments through their mobile phones in a simple, secure and easy way. Our system will have none of the above shortcomings of existing approaches, and will allow users to pay, track, manage and receive funds transfer between a group of suppliers and banks as long as they are subscribed to MOP system.

The remainder of this paper is as follows. Section II is the review of existing mobile payment systems. In section III we present our proposed solution in some detail. Section IV discusses various aspects of the proposed system. In section V, we compare our proposed system with related work and methods. Finally, in section VI we have the conclusion.

II. REVIEW OF MOBILE PAYMENT METHODS

Currently, many schemes of mobile payment are in existence. Each scheme has its own principle of work, based on the business model applied to. In this section, we will describe the most popular m-payment services.

A. PayPal

PayPal is a proprietary solution belonging to PayPal Company, and its acts as the third party between customers and the merchant. PayPal charges the receiver; the sender doesn't pay for service. The figure below shows the interaction participants between the customers from one side and the operators or the financial institutions from the other side. All transactions are done through the Merchant. [5] [6]

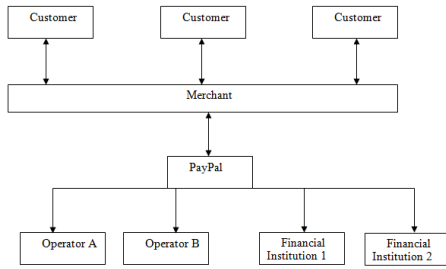


Fig. 1. Business model for PayPal

In PayPal, there are different ways to pay: 1) Web browser 2) SMS 3) Phone call. PayPal needs only a mobile phone and PayPal account, which is activated by using already existing financial means, such as credit cards or bank accounts.

B. PayBox

PayBox working principle can be presented as a message to be sent from the customer's mobile phone to the merchant. Then the merchant sends all customers' information, including the price of service, to PayBox. PayBox authenticates this order by the customer using a voice message. After that, the customer continues the payment by sending a PIN code to PayBox. Finally, PayBox asks the financial institution to complete the process and inform the merchant that the transaction has been completed via SMS report [6], as shown in figure 2 that describes the process and interaction.

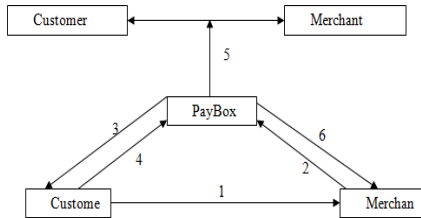


Fig. 2. Business model for PayBox

C. PayforIT

Pay for IT provides mobile payment services in the United Kingdom and has been used by most mobile phone operators. The application supports micropayments. In this method, the user needs a mobile phone only, without any other requirements, like a credit card or bank account.

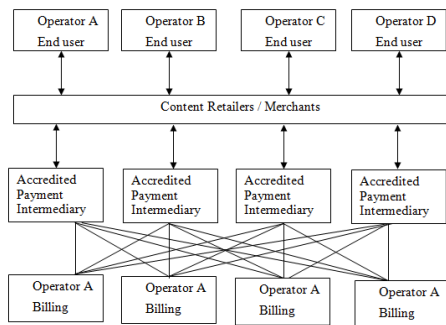


Fig. 3. Business model for PayforIT

The actors in PayforIT are: customers, operators, merchant and an additional participant layer, who authorizes the payment intermediary [6]. Figure 3 depicts the process. The customer must sign a contract by mobile phone with one of the authorized payment intermediaries. PayforIT

screen that contains all information about goods, merchants and price will be shown to the customer. The process is performed when the operator authorizes the payment. Finally, the cost is transferred to the mobile account.

D. I-mode Mobile Payment – Osaifu- keitai

Osaifu- keitai provides different mobile payment services in Japan. It's means Wallet Mobile use of IC "smart card" and has been introduced by NTTDoCoMo. The customer needs a mobile phone that is compatible with i-mode card reader. All the charges are transferred to NTTDoCoMo, who is in charge of billing to the users. The interaction participants are shown in figure 4. [5] [6]

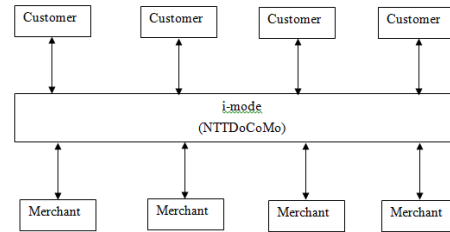


Fig. 4. Business model for I-mode mobile payment

III. PROPOSED SOLUTION

Financial organizations aim to use mobiles to be the main technology in payments. This due to the great speed of using mobiles by people worldwide, which include all financial movements of individuals and groups. That is what is going on between the P2P, B2B, and P2B to make things easy, and provide safe and qualified services. In our proposal, there is no specific type of mobile required for the service. Rather, it works on building a whole and unified service for all involved parties. The main idea is excluding any third party and relying on the current system and its credibility. This connection between the old system and the modern one saves time and trust for the beneficiaries.



Fig. 5. Solution Platform

As shown in figure 5, any recipient or sender should be connected to the bank account through his/her mobile. Depending on the transaction type, a bank may be an issuer (the party that sends money), or the acquirer (the party that receives money). In this mechanism, private information about users are kept in the banks only. Only the name, account number and mobile phone number are saved in the proposed system. The central bank is the correspondent between the banks and is used to help in making the financial movements of the clients of other banks in addition to its role in monitoring, legislation and evaluation. This system works on the powerful payments system which becomes a source of trust and development for the users and beneficiaries. It excludes any third party, especially mobile network operators (MNO's), which do not always enjoy the trust of users. So all processes are controlled by banks, the users, beneficiaries, and monetary parties such as the central bank and financial institutions. Most of the service suppliers and consumers have

bank accounts, hence the positive response to any proposed system involving banks that they trust. The central bank and the financial governmental authorities support this system which helps in monitoring, legislating and evaluation. This is the Real-time gross settlement system (RTGS), i.e. a specialist funds transfer system where the transfer of money or securities, takes place from one bank to another on a "real time" and on an economic basis. There are two sub-systems in our proposal: Client and operator. The client component will be used exclusively by the bank, connected to its core banking system. To ensure the security and efficient transfer of data, protocol 8583 will for data exchange. Also, the client's data will be coded by the bank in the host security module (HSM), which will works to keeping all data related to the client. No part of the data, except names, mobile phone numbers and account number of clients will be made available to other parties. The operator component will be installed in the central bank or any organization appointed by the government to monitor the financial movements in the country which helps in the financial process life. In addition, this part connects all banks together without need to connect each bank direct to other banks directly, thereby helping in preventing money laundering. The PIN and the other confidential requirements of any client like the historical data, account details and the personal data will be authorized and used only by the bank. What will be available is the name, mobile number, money amount and the bank account number as shown in figure 6.

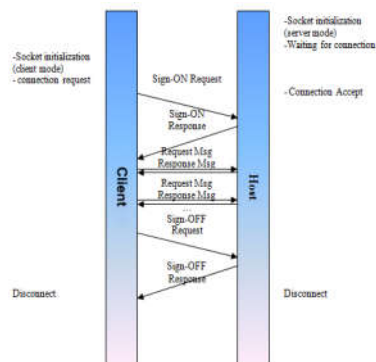


Fig. 6. Messages exchanges between client and core bank system

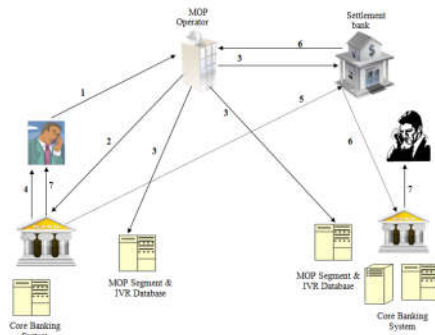


Fig. 7. New mobile payment behavior

Figure 7 depicts the sequence of actions that need to take place in our proposed method. These are explained below:

1. Issuer requests transactions through the MOP operator,
 - Using IVR, SMS, USSD or browser.
 - Issuer enters the acquirer MOP ID, amount, and currency.
2. MOP operator sends eligibility query to issuer bank.

3. If step 2 query result its ok, three internal transaction credentials are sent to both financial institutions and settlement bank.

4. Issuer bank requests verification code from the sender.

5. Issuer bank debits sender's account and sends "successful" message to settlement bank.

6. Settlement bank sends successful status to acquirer bank.

7. Issuer bank and acquirer bank send confirmation message to issuer and acquirer.

IV. DISCUSSION

The new system is applicable at all times and places, for personal and electronic purchases, transferring money (B2P, P2B, P2P), invoices and payments for all services like (e.g. water, electricity and taxes), electrical governmental payments (passport fees, licenses and other documents), school and university tuitions, speed cash, and international transfers. The main challenge in our system will be at checkout counters in stores which are crowded with clients. Each customer will need around 50-60 seconds to transfer money from his account to the store account, which means that others on the line may get impatient with the waiting. The benefits of the new system, however, are many, and can be summarized as follows.

A. The financial Level:

- Paying all payments through mobiles without a third party.
- Customers with no bank account will need to open an account, thereby resulting in new income to the banks through the operation of the account.
- The bank is the owner of this system and authorizes all data and requirements related to the clients.
- The relations and connections with other banks are via the central bank according to RTGS.
- Our proposal builds on the existing banking infrastructure for data exchange between banks. Therefore there is no need for additional investment for data exchange operations.
- Our proposal uses existing mobile phones, without the need for any kind of hardware or software update.
- It is based on the current financial infrastructure.

B. The User:

- No need to use cash or cards.
- Using this service to cover all invoices, purchases, fees, taxes, transfers and payments.
- Personal confidentiality.
- Deposit directly to the beneficiary's account without waiting 48 hours.
- Organizations and dealers can use this system in their financial movements and transfers, point of sale (POS), and prepaid payments while avoiding any fees of POS.
- The system permits peer-to-peer or personal transfers, which credit cards disallow.

- No specific mobile phone is required; all smart phones and cell phones can be used.

C. Monitoring and governmental organization:

- Confidentiality of the client's data.
- Supervised and monitored by the governmental authorities to prevent money laundry, cheating, and other risks; this increases the government's income.

V. RELATED WORK AND COMPARISON WITH PROPOSED APPROACH

In recent years, different studies which focused on mobile payment using different techniques, especially those which use technology, ecosystem (i.e. m-payment market and provides) and adoption [7]. But most researches and articles focus on a single issue without investigating the correlation with other strategies, while other researchers take more than one factor in mobile payment to study. Many literature reviews were written after 2013 about the researches that address mobile payment. Most of them focus on the developing countries, and this can confuse the results of M-payment researches, since there is a significant difference in the financial market and the telecom infrastructure.

The authors of [8] investigate the relation between technology for m-payment and its influence on the ecosystems, and how this payment can integrate with the ecosystem without unstable influence on other traditional payments. This requires more collaboration between the stakeholders due to the strong and competitive eco system schemes.

A different study asserts that the development of mobile payment systems depends on country-level institutional constraints – including compliance with industry-based and resource-dependent views.[9].

The authors in[10] investigate the main impacts of mobile payment on banks and financial institutions and requirements for m-payment from resources and different assets.

In [11] the authors investigate the collaboration between banks and mobile network operators (MNO's) in Netherlands.

According to a case study in Denmark [1], the authors conclude that the market corporations' strategies in mobile payment range from sharp to flexible method of payments. This article also differentiates between technology from both defensive and offensive strategies in m-payment.

In [12] authors study the timing factor and its impact on the optimal decision for success and complete advantage in mobile payment.

It's obvious that with time and due to the vast growth of the technological methods and applications, the need for and interest in security and privacy issues, which are considered to be the most vital issues in this field, have attracted many researchers. Many other interesting issues in this field also grab the attention of researchers, such as message protocol (data interchange), security proofs, authentication (PK, WPKi, PKi), m-payment protocols, trusted devices, cryptographies, 3D security, non-repudiation and finance. In

the literature, many articles mention one or more of the subjects mentioned above[13] [14] [15] [16] [17] [18].

The most important adoption factors for mobile payment services are: trust, risk, perceived ease of use, perceived usefulness, cost and mobility. Many of these factors have been previously investigated in research and their impact was studied under certain scenarios [7]. [13] studied the effect of cultural dimensions, [15] integrated mental accounting theory into technology acceptance model, [19] studied the adopt transfer of learning theories to investigate how technology usage habits affect in mobile payment users, [20] studied using m-payment in parking, fare tickets and money transfer addressed the adoption factors for different technologies. [21] addressed the payment habit, and [22] investigated trust in many stakeholders and issuers in mobile service provider, vendor, environment and technology.

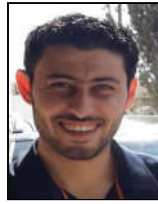
VI. CONCLUSION

Current implementations of mobile payment systems have various drawbacks and limitations. In this paper, we studied the mobile payment methods and proposed a new communication network that connects banks together and allows the customer to do all types of transactions through a mobile phone without the need for any enhancement of SIM chip or handset, in a simple, more secure, and easy way. In our proposed method we allow Real Time Person to Person (RT P2P) transactions between users who have accounts in different banks, without the need of a third party which is responsible for the transaction. Most of the mentioned drawbacks in other approaches are thus eliminated in our proposed solution. Furthermore, since our proposed system is built over the already existing "banking system" infrastructure, consumers can more easily trust it, due to the fact that all processes are done by financial institutions that are controlled by regulator authorities.

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