Payment System for E-commerce using mobile phones infrastructure

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Abstract — **This paper introduces a new digital payment system for E-commerce, based on Simple Messaging System (SMS) technology. This SMS-based payment system is secure, cheap, and easy to use. It is also very accessible because of the widespread of mobile telephones in the world. In this new system the commercial transaction is initiated on the internet when the customer makes a purchase. After that the customer uses his mobile phone to make a payment for that purchase which will be deducted from his account with the mobile operator.**

Index Terms — **E-commerce, Mobile Networks, Digital payment system, Internet, Simple Messaging System (SMS).**

I. INTRODUCTION

The internet has become an important channel for commerce in the 21st century [1]. In 2003, Business to customer e-commerce transaction value exceeds the $100 Billion, while the value in the business to business sector has reached more than $1000 Billion [2].

Payment systems are a crucial enabler of this e-commerce revolution. Without a ubiquitous, secure, and easy to use payment method, e-commerce would not flourish, especially in the B2C sector. Many forms of payment methods have been developed for e-commerce. In 2002, Credit cards accounted for around 80% of online payments and about $80 Billion of online transactions in the US [3]. However, credit cards are not accessible by many people in the world; and it is hard and expensive to protect them against fraud.

Our proposed solution uses the existing mobile infrastructure to allow people to pay for their online purchases. A mobile phone payment system called SIMPAY has already been proposed in Europe by a consortium of mobile phone operators [4]. This consortium includes: Orange, Vodafone, T-Mobile and Telefónica Móviles. It enables the payment of small amounts of money through a personal mobile-phone, taking a small commission off of every payment. However, before launching, SIMPAY operations were "scaled back" [7]. This is due to the fact that the mobile operations volume was not enough to sustain a successful growth of the company. In addition, mobile operation collection costs in Europe are too high.

The number of people who own mobile phones in the world is growing exponentially. In Asia, it is expected that by 2009, 901 million people will be using mobile phones [5]. The penetration rate of mobile phones in the world is by far larger than any other type of technology in history, including of course any payment system technology that currently exists.

In addition, mobile phones are becoming increasing useful for browsing the internet. Should these two functions combine and be used for payment, this will proof to be an attractive payment system for buyers and sellers alike.

Our proposed system is different from SIMPAY, does not require the customer to access the internet using his mobile device. He or she can pay for purchases with any mobile telephone that can send SMS. The E-business has a mobile number to which an E-commerce customer sends an SMS message to pay for his or her purchases. The payment amount will be automatically deducted from his or her mobile account with their mobile service provider. In fact, our system can potentially be also used offline. The new SMS payment system is secure, cheap, and easy to use. It is also very accessible because of the widespread of mobile telephones in the world.

The remainder of the paper is organized as follows: in section II, an overview of digital payment systems if provided. Then, in section III, the proposed SMS-based payment system is described. This is followed, in section IV, by discussing the cost of adopting such a system to the customer and the E-commerce website, and, in section V, a discussion of the features

and advantages of the new system is included. Finally, security issues of the new system are discussed in section VI.

II. OVERVIEW OF DIGITAL PAYMENT SYSTEMS

Digital payment systems are one of the main components of E-commerce and the economic and financial infrastructure. Without a secure, user-friendly, and ubiquitous method of payment, commerce over the internet can not succeed. A payment system is an arrangement which allows the users to transfer "money". What constitutes money has long been a central question of monetary theory; its use and definition has varied over time and from country to country. Nowadays, there are many types of payment systems including cash, checks, credit cards, stored value (such as debit cards), and accumulating balance (such as utility bills). E-commerce technology offers a number of possibilities for creating new payment systems. Using E-commerce technology new digital payment systems have been created to allow commercial transaction online. These include:

- Digital cash: Systems, such as www.paypal.com, that allow you to have an account with funds that you can spend online.
- Digital Checking: systems that allow a customer to issue a digital check and allow existing bank checking systems to clear them.
- (Digital) credit cards: credit cards are the most common method of payment on the internet. Digital credit cards that are specifically issued to customers to be used for online payments only have also appeared.
- Digital accumulating balance and online stored value systems are also being used by some E-commerce web sites.

In 2002, credit cards accounted for around 80% of online payments in the US [3]. While only 50% of consumers outside the US use credit cards for online commerce. In Europe and Asia rely more on Cash on Delivery (COD) or bank transfers as a method of payment online. The type of online payment system used in a particular region of the world is heavily influenced by the financial infrastructure.

III. The proposed new payment system

In many parts of the world, including the Middle East, financial infrastructure is still underdeveloped. Thus many of the current online payment systems are not suitable and or can not be supported. For example, credit cards are not accessible, nor affordable for the majority of people. Digital cash systems or prepaid cards are available but they are still costly because of the needed infrastructure to support them.

On the other hand mobile phone infrastructure has grown exponentially over the past few years to cover large numbers of people around the world. A payment system that takes advantage of this existing infrastructure will be highly attractive.

We already have some commercial transactions that occur today through mobile phones, where people can, for example, purchase ring tones and logos for their mobile phones. The payment for these purchases is automatically deducted from their account with the mobile operator. Our proposed solution is an extension of this model. It involves using mobile phones to make payments to E-commerce websites. For example, if a person purchased a product from a website, they provide their phone number instead of credit card number. The E-business than sends an invoice via SMS to the consumer, who than acknowledges the payment by entering a PIN and sending an SMS back to the E-business with the payment.

The process of performing a commercial transaction in the SMS payment system involves the following steps, which are also illustrated in Fig. 1:

1- The customer provides a mobile-phone number to a seller via its e-commerce **website** indicating product required.
2- Seller sends an **invoice** to the customer via SMS.
3- Customer sends a **confirmation** to the mobile operator after entering a private identification number (**PIN**) locally (within the phone) for security.
4- Mobile-operator checks the mobile-phone's account for **funds**. If enough funds are available, mobile operator sends them to seller via bank. If not enough funds are available, transaction is denied.
5- Mobile-operator sends a **notification** of payment to seller via SMS.
6- Seller sends receipt to customer via SMS and delivers the **product** to him.
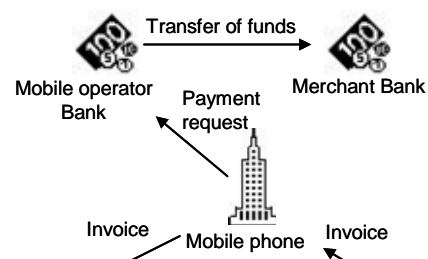
occurs, the order is sent through the internet to the company's web server. The company sends an invoice to the customer via the SMS server. The SMS server is a server running special software that:

- Allows it to connect to the wireless mobile network and send invoices and receipts via SMS.
- Receives confirmations from customers from the mobile network to complete transactions
- Can apply encryption and error checking techniques for its communication with the customer so that it ensures securely and reliability.

From the customers point of view the new SMS payment system is accessible and ease to use. In order for customers to be able to use this service, he or she needs only to have an operational mobile phone. Then the customer needs to register with the mobile-service operator, and set a **PIN** for his mobile device. The PIN helps ensure that the customer will enjoy as security as much as possible when using the mobile phone payment. The steps to enable such a system on a mobile device are then simple and affordable to any customer.

V. ANALYSIS AND DISCUSSION

The new SMS payment system has the following features and advantages:

1. It is more *accessible* since almost everybody nowadays has access to a mobile phone.
2. It is *cheaper* because it is based mainly on SMS type of communication.
3. It is *easier* to use as a method of payment because they involve the use of mobile phones.
4. It is can be used for both micro-payments and medium value payments.
5. It can be configured to have any *float* period. (the period of time between the purchase and the actual payment for it).
6. It is *safer* because it is more limited in funds, does not include sharing sensitive numbers on any network, and relies on the customer entering his local-PIN code in order to fulfill the transaction the funds. Furthermore, if somebody wants to use the account of somebody else's mobile-phone number, then the owner of the phone would be notified. This is unlike digital-payment tools where usually, no automated alert is sent to the owner of the digital-payment tool before the transaction takes place.

On the other hand, these are also some potential problems with this system:

Fig. 1. **New payment system** based on SMS messaging and uses the mobile-operator as the third party to arrange the payment.

IV. COST OF ADOPTING THE NEW SYSTEM

On of the main features of the new SMS payment systems, is that it takes advantage of the existing mobile phone infrastructure. For this reason the cost of adopting the new payment system is low.

From the E-business side, it needs to include new hardware and software to its E-commerce platform. Fig. 2 illustrates the proposed modifications and additions to the E-commerce platform. We propose adding an *SMS server* to the E-commerce platform to enable it to use the new SMS payment system. The new SMS server must have a connection to the wireless mobile network. It should also have the necessary hardware and software to support the new SMS payment system, including encryption and error checking.
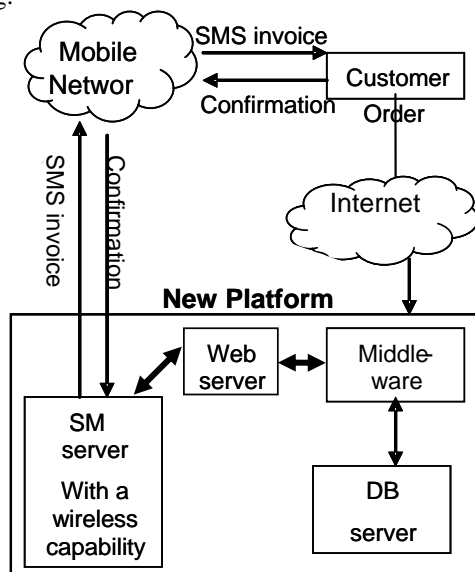

Fig. 2. **New IT platform** required for e-commerce website to use the new SMS payment system.

The mobile network is the link between customers' mobile phones and the business. Once the transaction

1. The mobile-phone must be physically available for the transaction to take place. However, people carry their mobile phone with them all the time.
2. Spam is more likely to occur because fake merchants would attempt to fool a customer by sending fake invoices to customers. However, since there is a cost to each SMS message, the volume of this SPAM is expected to be manageable.

VI. SYSTEM SECURITY

The security of any payment system is paramount to its wide adoption and success. The system must guarantee confidentiality, authentication, integrity and non-repudiation of the commercial transaction.

In the new SMS payment system, the information exchanged between the E-business and its customer includes: the customer's mobile phone number, invoice, and receipt. All of which is not sensitive information that must be kept confidential. However, if confidentiality is needed then a form of SSL encryption algorithm can be used. SSL would also insure integrity of the communication between both parties. Integrity is about keeping the information unchanged from its original source all the way until it gets to its destination. Integrity is necessary so that invoice details such as the product, its quantity, or price are unmodified.

Finally, non-repudiation is authenticated proof that a message has reached its destination. It is guaranteed by the presence of a third party in the transaction, namely the mobile operator.

VII. CONCLUSION

In conclusion, this paper presented a novel SMS-based payment system that exploiting the existing infrastructure of the wireless telephone network. The new payment system is easy to use, cheap, and secure. It can be also be used with micro-payments. However, like any new system it needs the support of the key players, namely here the mobile telephone network, and the E-commerce websites. However, they should be interested in this new system because of its high cost effectiveness.

Our future work is to attract some funding to implement a working prototype of the new system in order to investigate its properties and test it in the real world.

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