Cardless Withdrawal System for Mobile Banking Applications

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Abstract: With the whole world going mobile and with the threats represented by third party mobile payments, the banks need to react and offer their clients innovative integrated solutions for payments and money transfer. Mobile banking applications are more and more used, and the possibilities to expand are still open. A cardless withdrawal solution integrated in an already developed smartphone mobile banking application might just give an edge in the fight with other competitors. By using SMS technologies for sending money to other people the appeal of such an application will rise considerably and will attract more and more clients. It is very important to keep the mobile payment endorsers as clients of the bank and not some other provider.

Key-Words: Mobile banking, Mobile payments, Cardless withdrawal

1. Introduction

The goal of this paper is to analyze the opportunities present in the current banking environment represented by mobile technologies and to provide a valid solution that will increase the quality and innovation of the services offered to the customers. In the current informational climate, where more and more businesses go mobile, it is important for all companies to go with the trend. Banking institutions are included here as well, for which an increase in revenue is vital in this troubled times. A good way to do this is to attract new customers with interesting and innovating new technologies. Also, considering the big number of unbanked people in developing countries, a way to address to them as well could represent a huge advantage. The cardless withdrawal solution presented in this paper would be applicable to both categories of people, the highly technologized ones, as well as the unbanked ones.

2. Problem Formulation

With the number of smartphone users growing continuously, the market of mobile banking applications and mobile payment systems will probably experience a huge rise in the following years. So this is the area where banks should consider developing in the future. At the moment mobile banking technologies are growing rapidly. More and more people are using them and relying on them for their regular banking activities. Almost all banks have mobile banking applications of some sort or another, so getting ahead of the competition can be done only by innovating.

2.1 Mobile banking

Mobile banking is an extension of the existing payment infrastructure of a bank to mobile phones. It is very similar to Internet banking, sharing many features. But, unlike Internet banking supports only one implementation, Mobile banking can be realized in a number of ways. One of the most simple usage scenario is to use the mobile phone's integrated browser to access the Internet banking web site, a first way to do banking on the mobile. Other implementations include SMS or USSD communications between the telephone and the bank, on which no application actually needs to be deployed on the client's mobile phone. Finally we get to the mobile banking applications that are deployed to the customer and use different communication methods to access the bank's servers, the most frequent and most versatile being the use of the Internet (GPRS/3G/HSDPA).[1]
In the last couple of years, more and more banks and other mobile payments providers have started to implement different ways of mobile cash withdrawals. Even if this means in many cases changes made to the ATM machine, or using other types of terminals to dispense money, this looks like the future in banking [3].

2.2 Current implementations

There are some solutions already designed and launched at the moment that implement cash transactions between users using mobile banking applications. A strong diversity can be observed regarding the technologies used and the architectures proposed. Besides this, some systems are not even bank centric, the main authority being the mobile telephony provider.

M-PESA

Probably one of the most successful and well known implementation of mobile banking is the Kenyan M-PESA. For many years, phone companies have allowed individuals to store pre-paid cell phone credit and even transfer that credit to each other. In March 2007, the leading cell phone company in Kenya, Safaricom, formalized this procedure with the launch of M-PESA, a SMS-based money transfer system that allows individuals to deposit, send, and withdraw funds using their cell phone. M-PESA has grown rapidly, reaching by 2010 approximately 38 percent of Kenya’s adult population, and is widely viewed as a success story to be emulated across the developing world. [4] Even though no banks are involved, M-PESA can be seen as a personal mobile banking system. Since the launch of M-PESA in March 2007, Safaricom has been at pains to stress that M-PESA is not a bank. However, considering the good covering across the country and the lack of penetration of regular banking in the rural regions, M-PESA accounts became substitutes for bank accounts and reached the unbanked population. The ease with which M-PESA users are able to transfer money to each other and collect the cash from any Safaricom agent or cash dispensing machine, could represent the grounds for many future mobile banking solutions. Other advantages of M-PESA include the fact that the money receiver doesn’t necessarily have to be registered to M-PESA and that the system could work on any type of mobile phone with a valid SIM card and SMS capabilities.

You can see the rapid growth of M-PESA in Kenya in number of new users per day.

![Figure.1 Average daily growth in M-PESA registrations by month](image)

NatWest and RBS “Get Cash”

In 2012, NatWest and The Royal Bank of Scotland both from Great Britain launched two systems called Get Cash and Emergency Cash. These were integrated in the mobile banking application that the two banks already provided. The Get Cash system enables users to request an amount of cash using their mobile banking application, which will then generate a 6-digit pin to be entered at an ATM. This is the only validation that takes place at the ATM machine. The simplicity and also the vulnerability of the system stands in the fact that any user could withdraw money from the bank knowing only that 6 digit PIN number [8].

Absa in South Africa

A more secure cardless withdrawal system was developed in South Africa by Absa Bank. The Absa cellphone banking facilities are not as developed as the ones from NatWest and RBS, being implemented using a mobile optimized version of the Internet banking site, the transaction communication being done through SMS and USSD technologies.
Absa’s Cash Send service is aimed at benefitting both banked and unbanked South Africans. The system allows users to transfer money to any recipient from their account and the cellphone banking application. The sender will enter the cellphone number of the recipient, as well as select a six-digit access code. A system-generated 10-digit withdrawal number will then be automatically sent to the cellphone number provided. The system also generates a 10-digit number, which is provided to the sender for reference purposes. The sender then contacts the person who will receive the transfer and provides them with the access code and the amount to be transferred. The recipient uses the code at an Absa ATM to withdraw the amount [9].

2.3 Security concerns
A key area of concern for consumers and financial service providers is the security of mobile banking and payments. One of the key security concerns of mobile banking systems is the enrolment phase. There should be a balance between an easy way of registering that will attract the customers and thorough verification methods of identifying the person how subscribes to use mobile banking applications. This is where the initial NatWest Get Cash system failed, when attackers could register to mobile banking as a different user and accessed his account withdrawing money. Even though the security features of the system were strong and correctly implemented, the trust in the system soon disappeared after that particular incident [5].

3. Problem Solution
The solution would be a system that will target people from both worlds. A system that highly technologized users would embrace and that will also benefit unbanked people with regular phones not smartphones. Through the technologies involved, this will be a highly attractive smartphone mobile banking application, with all the capabilities of any modern mobile banking application. Also, having a cardless withdrawal system, which we will call Quick Cash, and the possibility of sending money to other people than the bank clients would be highly appreciated. In the following pages such a system will be described.

3.1 General description
Unlike other systems that are mobile operator orientated, this solution is using a bank centric architecture.

This means that in order to be able to use these functionalities, one should first be a client of the specific bank which implemented the solution. The other prerequisite is that the client registers, downloads and uses the mobile banking application provided by the bank. Through the mobile banking application the user can easily do various tasks that otherwise would have taken him a lot of time and energy. Here we can include actions like checking his accounts and balances, paying bills, performing money transfers from his accounts, checking his transaction history and finding available ATM machines near him. These facilities are generally available in all the current smartphone mobile banking applications. The key and the innovation of this solution is to combine all these capabilities with a cardless withdrawal system commanded from the mobile application that will allow people not only to withdraw money themselves, but also send it to other people who may not even have a bank account.
3.2 Usage
Such a system may have two main usage scenarios. First of all, it is a quicker way to get cash from your bank account. In the world we live in, any second counts, and being able to enter the details of a cash withdrawal transaction from your smartphone will reduce the time you spend once you get to the ATM. This will be highly effective also in situations like forgetting your credit/debit card at home or in the office when you go to get a cup of coffee.

The second scenario is one in which you can use the application to send cash to a friend from your account without needing anything else than his phone number. Considering this, the person you are sending money to may have lost his credit/debit card or may not even have an open account. Here we can include also people who have relatives without accounts and live in distant places in the country. It is much easier to send money to them using this system than using postal services or Western Union, and also the commission fees would be much smaller. All they would need in order to receive the money is a mobile phone with SMS capabilities and one of the bank’s ATM machines in their vicinity.

3.3 Architecture
Let’s take a look at how this system works. As stated before, the cardless withdrawal system will be integrated in the mobile banking application and will be available from the menu.

When making a Quick Cash request, there is a small number of steps you will have to take. First of all you will have to select the account from which you want the money to be withdrawn. A list of all your available accounts will be displayed and you can select any one of them. Next, you will have to insert the amount you want to receive, the phone number of the person you wish to send the money to, and a 4 digit PIN number that will authenticate the transaction. The amount limit for daily usage for Quick Cash transactions will be set by the bank and communicated to the client.

If you wish to withdraw the money yourself, you will have to insert your own mobile phone number. If you wish to send the money to someone else, you will have to insert their mobile phone number. A very important note is that the receiver doesn’t have to have a smartphone. All he needs is a telephone with a valid phone number and the possibility to receive SMS messages.

After the request has been sent, it will be processed by the banking server. If the client has the requested amount in his account and hasn’t exceeded the daily limit, the transaction will be approved and a random, unique 8 digit transaction code will be generated on the server. This code will be sent through SMS to the phone number inserted in the request. If the recipient is other than the client, it is up to him to send the 4 digit PIN number from the request to the person who received the money. This way, using two different codes for each transaction, a higher level of security is ensured. Also, no one else but the recipient will ever receive the 8 digit transaction code.

![Figure 3. Quick Cash cardless withdrawal architecture – send cash](image-url)

The final step is to get to one of the bank’s ATM machines and instead of inserting a credit card, you will select Quick Cash. All you have to do is to type the transaction code you received from the bank and the authentication PIN received from the money sender. If the transaction code is a valid one and hasn’t expired, and the PIN is the one corresponding to this transaction, the ATM will dispense the previously established sum of money.
For a higher level of security, the transaction code will expire if not used in the next hour after it has been generated. Also, at the ATM, if for one transaction a wrong PIN was introduced 3 times, the transaction code will be disabled and in order to perform the action, another Quick Cash request should be submitted. Also, the probability of guessing a correct active transaction and the associated PIN number is very small. As a final level of security, after the transaction is validated and the money provided, a SMS notification will be sent to the account owner, informing him of the transaction. This way, even if through phishing or some other illegal way an attacker could pose as the client and generate a Quick Cash code, this will be discovered after the first transaction in order to prevent large sums of money to be hijacked.

3.4 Security

One of the main security features that need to be implemented is to use a secure channel for communications between the mobile banking application and the bank [10]. This will of course be done by using the encryption provided by the SSL protocol. This will protect the application from any sniffing of the packets sent to the banking server. Another key feature is to never send passwords or PIN numbers in clear over the Internet. For this purpose a secure hashing algorithm like SHA256 or SHA512 should be used. In the particular case of our cardless withdrawal system, the transaction PIN that will further authenticate the transaction, set by the user from the smartphone should be sent hashed, and when checking its value at the ATM, hash the PIN inserted by the user. Also, note that the transaction ID is generated randomly on the server. Even though a good pseudorandom number generator can be used, as we are talking about a secure banking application, in a real deployment of such a system, a true random number generator should be used. This way, it will be absolutely impossible for an attacker to guess what the next generated Quick Cash transaction ID will be. Besides this, having a two code transaction authentication system at the ATM machine, highly increases the level of security of this proposed solution. Finally, the option to use SMS messages for communicating the transaction ID is a very secure solution, as SMS messages are significantly harder to intercept than Internet traffic. Also, sending a SMS notification after each transaction has occurred would prevent any attacker to withdraw more than once without alerting the account owner. And by sending the SMS with the transaction code to a telephone number, if the situation would require it, an attacker could be easily identified.

4. Conclusion

Although many other solutions with different implementations can be developed in this particular case, it is obvious that this is the direction personal banking and micropayments are going. The ability to combine the versatility of mobile technologies with a good security architecture could provide a real consistent solution in the following years that will be adopted at large scale. As for the solution presented in this paper, it combines the best parts of the technologies used in other current implementations and provides a well-balanced and innovative system that will prove to be effective when implemented.

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References