

# DESIGNING A SYSTEM FOR CONTACTLESS PAYMENT BASED ON NFC TECHNOLOGY

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«Бесконтактные технологии» сегодня знакома не только специалистам IT-сферы, но и рядовым пользователям современных сервисов. Во введении была описана важность бесконтактных технологий, которые имеют огромные перспективы применения в самых разных сферах – от ритейла до медицины и образования. Безналичные платежи; транспорт; системы учета времени, идентификации и контроля доступа; интерактивные инфостенды и смарт-постеры; социальные сервисы... И это еще далеко не полный перечень тех областей, где может пригодиться прогрессивное изобретение. Бесконтактный способ связи взяли на вооружение и банки.

Практикой доказано, что банковская сфера – это одна из тех областей человеческой деятельности, где использование информационных передовых компьютерных технологий оказывается наиболее эффективным. Последние десятилетия были периодом внедрения новых компьютерных технологий, кредитных карт и важных инноваций денежно-финансового рынка. Аналитики и представители отрасли обсуждают внедрение технологии бесконтактных платежей и её перспектив с запуском новых платёжных сервисов.

Понимая важность и необходимость платёжной системы для бесконтактной оплаты услуг в Беларуси и, в частности, в городе Гродно, в основной части было обосновано решение о создании платёжной системы, которая будет поддерживать белорусские карты и при этом не будет уступать существующим системам, так как в своей основе будет иметь технологию Near Field Communication, что обеспечит системы защищенность, надежность, скорость, удобство использования. В заключении были рассмотрены основные преимущества системы.

Актуальность темы исследования определяется активным развитием технологии бесконтактных платежей в Беларуси, являющих собою пример симбиоза работы банка, платёжной системы и телефона. Бесконтактная оплата с помощью мобильного телефона станет шагом на пути к отказу от наличных средств.

**Key words:** design, information system, payment system, diagrams, financial technologies, contactless, payment, payment systems, nfc.

It is almost impossible to go out without a mobile phone or an MP3 player, for example. These devices have become an important part of our life. Even banks are increasingly using digital technologies in their activities. The development of the economy of any state today is impossible without a highly efficient system of money circulation and the use of modern payment mechanisms for different payment methods.

Payment methods are divided into cash and non-cash. Non-cash payments are gradually crowding out cash payments in the monetary systems of various countries. But when I told non-cash, what do I mean. As in modern life people more and more forget about cash and daily use smartphone, banks started to create payment systems. And it is not everything that banks do. They create contactless card, let people pay with the help of QR and Near Field Communication (NFC). A contactless bank card is really a convenient thing. You don't need to stick anything, remember the PIN code, scribble checks with a bad-writing pen, not to mention counting bills and looking in the pockets to find money. Touch - and ready. And you are free. Contactless payments are also a perfect solution for salesman, since they allow you to speed up the payment process. And you as a customer doesn't need waste your time by paying. Contactless bank cards use NFC technology, a type of RFID, for data transfer.

Now the smartphone can emulate cards and people are able to pay with the help of only the phone and don't think about the cash. And don't worry the developers are thinking about secure. There are many people who think that payment system are not secure but you need to understand that the banks also care about their reputation. And they make their payment systems secure year by year [1, p. 42].

Payment system is an important element of the financial and banking system of any country, that allows for non-cash transfers of funds between various business entities. At the moment, there is a great variety of payment systems, for example PayPal, WebMoney, EasyPay, Apply Pay, Samsung Pay, that provide the simplicity and speed of payment transactions. Such systems will make it possible to judge the level of technical and economic development of the country, as well as increase the standard of living of the population in this country.

In Belarus, not so long ago, the first contactless payment systems began to appear. They are still far from perfect, and not particularly common. And therefore, in this course paper, we will design a payment system project for the city of Grodno, take into account all the pros and cons of existing systems and try to achieve maximum versatility. The theme of this article is relevant, since in modern life, cash payments for goods and services are becoming obsolete. To simplify and expedite payment, contactless payment methods were invented.

Contactless cards are both settlement and credit cards. At the same time, there are contactless cards with payWave and PayPass technologies. For MasterCard Worldwide, this contactless payment technology is called PayPass, for VISA, it is called payWave. There are no special differences between them, the methods for using such cards are almost the same. A contactless card is a classic bank card that allows you to pay for goods and services with one touch. Such products are equipped with a special microchip and this microchip transmits a signal without contact with the terminal. Contactless card has its benefits. First of all is security [2]. You will completely control the payment process, since you don't even need to give your card to the cashier. Your card signal is transmitted at a short distance, which eliminates the possibility of its interception. One of the benefits is also efficiency. The payment process takes a few seconds. And, of course, reliability. You will not be able to pay one purchase twice, even if the card remains on the terminal. After the payment, the terminal is disconnected. Contactless payments can only be made in places where the MasterCard PayPass or Visa payWave logos are present or logo of contactless payment (figure 1).



**Figure 1 – The emblem of contactless payment**

The purchase process looks like this:

1. You check the payment amount entered by the cashier.
2. Bring the contactless card to the reader for a moment.
3. A sound signal sounds and an inscription appears on the display that confirms the fact of payment.
4. The terminal is turned off (this excludes the cancellation of a double amount).

If the amount of your payment more than twenty rubles (this is the established limit for Belarus), then you will additionally need to enter a PIN code or you will receive a check for signature from the cashier. In some countries, a certain limit will be possible to pay for a purchase only by contact.

The advantages of contactless payment are:

- record speed of payment transactions;
- convenience of payment;
- no need to transfer your bank card to an unknown person (cashier);
- no need to spend time entering a PIN code (up to the set limit);
- service life compared to ordinary "plastic" (such a card is less exposed to mechanical stress);
- the ability to use contactless cards in ordinary ATMs or terminals;
- reception in more than 30 countries.

Also, contactless payment is very secure. But, of course, you have a question how terminals at the store read information from the contactless cards and how terminal withdraws funds from your card. For understanding, let's read the official definition of contactless payment: Contactless payment is a secure method for consumers to purchase products or services using a debit, credit, or smartcard – also known as a chip card – by using RFID technology or Near Field Communication (NFC) and also QR-codes [4, p. 113].

It will be interesting to compare two wireless technologies: QR-code and NFC. NFC (Near Field Communication) and QR Codes are two wireless technologies. And both that can be used the same way: transfer data and receive data. There are some characteristics that differentiate one another though [5].

1. Infrastructure and equipment.

QR Codes are universal: every smartphone can potentially read a QR code, as soon as a QR Code reader app has been installed (app download just takes 3 clicks and is free). When it comes to NFC, not every phone has NFC.

2. Content access.

To read a QR code, users first have to open the specific QR Code reader application downloaded from the app store, and point their smartphone onto the 2D code to decode it. NFC is more convenient and faster: the action is automatically triggered when your phone comes within 10 cm (3.94 inches) near the NFC tag and you get instant access to the content on mobile - without a single click.

3. Branding

Today, you can create a special design for QR code. It can be a logo of your company or you can use your company's colors for QR code [6]. You have lots of advanced personalization options. Still, you have to follow some design rules so that your code remains scannable.

For NFC tags, there isn't any design restriction as the information is not encoded in the tag design itself. Tag can be completely hidden in your own support without affecting the capabilities.

#### 4. Price

QR Codes do not have a unit price, they are scalable: you produce them once and you can use or print them everywhere and as many times as you need without additional cost. NFC chips are a physical product, costs mostly depend on how many NFC tags you need.

Well, after analysis we decided to choose NFC for future contactless system.

NFC is very popular now. And more countries now what to integrate NFC with their economy to be digital country. Now mostly every smartphone has NFC. That's why we decided to create payment system that will help people from Grodno and tourists pay services and purchases with their phone.

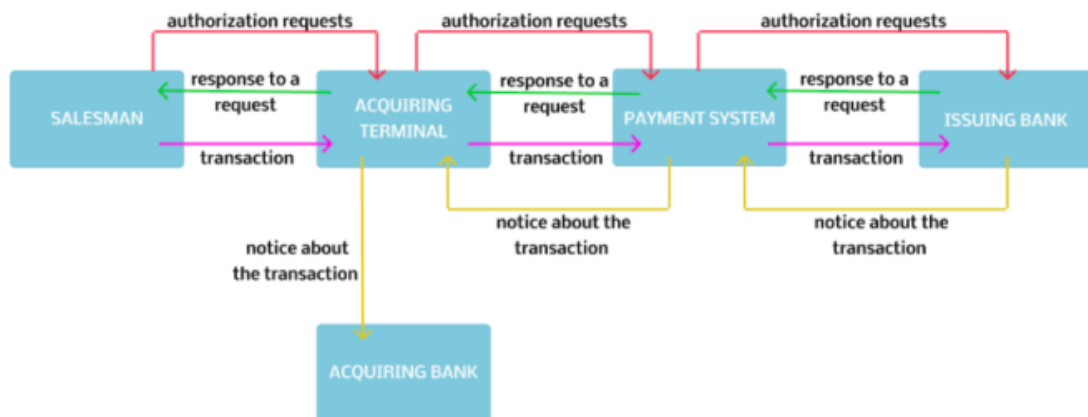
Yes, it is hard but possible. Advantages of NFC, that make us use NFC:

- quick and convenient – you just need to bring the card to the reader with the NFC icon;
- safe – operations occur after entering the PIN code of the card;
- without risk of forgetting the card at the ATM – throughout the entire operation the card is always in your hands.

Today smartphone with NFC can emulate credit card once. And after you don't need to take your card with you. The mobile phone is often the "carrier" of the NFC chip – the device is the most importantly inseparable from its owner, acting as:

- means of payment (app of the payment system or virtual wallet);
- means of identification of the owner;
- key, bonus card;
- ticket.

Currently, NFC solutions are already used in many areas all over the world. For example, using this technology, you can book and sell electronic tickets, pay for public transport and car park, NFC-technology is also actively used in the services and entertainment sectors, in the field of security and access control. But we still don't have it in Grodno. Here it isn't widespread. It is interesting, NFC chips are used not only in mobile devices in card emulation mode, but also in plastic cards themselves, for the possibility of contactless payment, and also in other common devices with the ability to emulate your card, such as a ring or bracelet with a built-in NFC chip. I read before about contactless payment mode and about contactless cards [7]. Now, for understanding, let's me demonstrate how transaction is going on (figure 2).



**Figure 2 – The process of tokenization**

The main goal of our payment system is to simplify the process of paying for services, make Grodno digital city with NFC payment system. We are not going to replace the current system of payment. We just wanted to complement the system.

We understand that not all people and tourists have cash to buy. Our payment system will help people pay using only their smartphones. If your smartphone has NFC you can use your phone as a card. First of all, you need to download the payment system from the store. As payment system is an app you can download it in one touch (click).

After downloading you should open the app and fill in the card details or can just switch on the camera, using special button on the app, in your phone and scan the card. That's all what you need to do to turn your phone into the card. As soon as the information is verified, the card data will be digitally displayed in the program on the phone. If you want to pay you just need to open the app and click to the big button in the center to activate NFC.

The information system that we are going to design – is a mobile application – is a payment system with NFC technology to give people the opportunity to pay without cash and credit card in the wallet.

Since our payment system displays in the form of mobile application. The mobile application functions:

1. Registration. When first use our payment system on smartphone, user need to create an account. In this step, the fingerprint and retina should be recorded.
2. Add credit cards. To add a new credit card, user needs to open the camera and scan the card and also fill in the CVV/CVC code. There will be the opportunity to fill in card's details by your own.
3. Delete credit cards. User can delete credit cards which he thinks it is unnecessary.
4. Check payment statement. User can check all payment statement on phone.
5. Payment calculation. User can select a date and the software can calculate the total payment amount during the selected period.
6. Pay with the help of NFC technology. To pay the user should touch NFC reader with his smartphone but before he needs to click on NFC icon.
7. Receipt. After payment the user will be able to see the receipt and if he wants, he can save it.

Thanks to use case diagram you can understand the features of the system. A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well. You can see use case diagram on figure 3.

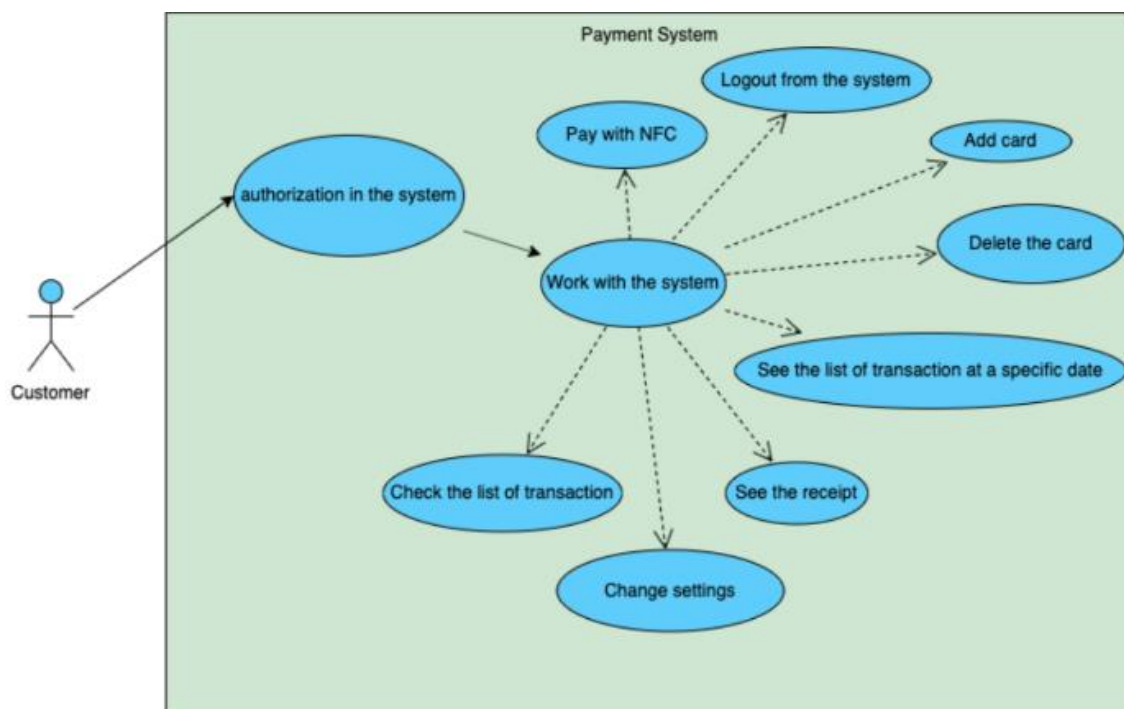


Figure 3 – Use case diagram

The benefits of contactless payment to users is obvious. Being a modern technology, mobile payment has several advantages in the speed and simplicity of making payments. And, of course, the main advantage of the contactless payment is security. Many experts say NFC really is fundamentally secure by virtue of its extremely short range. In order to snag your NFC signal, a hacker would need to be very close to you. Uncomfortably close. In other words, you'd know they were there. And unless it was a very intimate friend of yours, you'd likely not be happy about it. To pay with a mobile phone, just bring it to the terminal and the required amount will be written off. Unlike a card, today a mobile phone is always at hand.

Today, everyone has plastic cards and documents with microchips based on near field communications (NFC) or with radio frequency Identification (RFID).

This technology is promising because it presents the next evolution of convenient payment with an added layer of security. This technology will make upcoming smartphones powerful.

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