Why QR code payment develop well in China?

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Abstract— This article introduces the principles and benefits of QR code payment. Then it talks about the development of scanning code payment in China, and discusses the reason why QR code payment can develop well in China based on the viewpoint of HCI.

Keywords—QR code, payment, customer habits, third-party, HCI

I. INTRODUCTION

In recent years, with the increasing popularization of e-commerce applications and the continuous improvement of communication technologies, QR(Quick Response) code payment, as a new payment method, has been rapidly developed all over the world and has not only become an important growth point of mobile operators' business, but also has attracted banking finance Agencies, international card companies, Internet technology companies and third-party payment agencies and other subjects. In the last two years, China has made good progress in its code payment compared to other countries. This article talks about the advantages of QR code payment and it also analyzes the promotion of QR code payment for the improvement of user experience in China, as well as the change of user behavior.

II. RELATED WORK

Part of the previous research work discussed the architecture, function and design of QR code payment system [1]. Some people researched the application of using QR codes and the benefits of using QR codes. Other people also researched the similar quick payment technology like NFC. Lots of previous work focused on the security problem of mobile payment system. Based on pervious work, this paper researches the reason why QR code payment can develop well in China.

III. QR CODE

A. What is QR code

QR code is a two-dimensional code, which records the data symbolic information in a black-and-white pattern with certain geometric patterns distributed in a plane according to a certain rule. The "0" and "1" bit streams that make up the internal logic of the computer are skillfully utilized in the code making concept [2]. A number of corresponding binary geometry are used to represent the numerical value information. Figure 1 is an example of QR code. It automatically processes information through an image input device or a photoelectric scanning device. It has some common features of bar code technology: each code has its own specific character set; each character occupies a certain width; it has a certain calibration function. At the same time, it can automatically identify different lines of information, and deal with changes in graphics rotation point. [3]

B. Features of QR code

In addition to the advantages of one-dimensional bar codes, QR codes also have the advantages of being able to store a large amount of information, reliability, confidentiality and strong security.

Figure 1 QR code[4]
Relying on its huge amount of information carried, QR codes, can include the information in the bar code which is stored in the background database when using a one-dimensional bar code in the past. It can get the corresponding information directly by reading the bar code. QR code has error correction technology and security features, which increase the data security.

QR code has the characteristics of high density. At present, relatively mature one-dimensional bar codes such as EAN and UCC bar codes can not describe the products because of their lower density. If people want to know the information about the product, they have to read the bar code and enter the database. This requires that the user must create a database of indexed fields in advance with the code represented by the bar code. A QR code increases the information density of the barcode by utilizing the size in the vertical direction, which is usually several tens to several hundred times the density of the one-dimensional barcode. This enable people store all their product information in a QR code. If people want to see the product information, they only need to scan QR code by using QR code reading equipment. Therefore, this does not require the establishment of a database in advance, which realizes the description of the "item" by the barcode.

QR code has error correction function. One-dimensional bar code, when the bar code is damaged (defaced, deinking, etc.), it can only be handled by using the keyboard instead of scanning the bar code. One-dimensional bar codes do not take into account the error correction function of the bar code itself. Although the concept of checking characters is introduced, it is only limited to prevent reading errors. QR codes can represent thousands of bytes of data. Without error correction, the barcode becomes meaningless when some part of the QR code is corrupted, so a QR barcode introduces an error correction mechanism. This error correction mechanism makes the QR bar code still can be correctly read when it has local damage due to perforation, fouling. The error correction algorithm for QR codes is the same as the error correction algorithm used for satellite and VCD. This error correction mechanism makes QR code becomes a safe and reliable method of information storage and identification.

QR code can represent multi-lingual text and image data. The character set that most one-dimensional barcodes can represent is no more than 10 digits, 26 English letters and some special characters. Therefore, it is not possible to represent other languages (Chinese characters, Japanese) with one-dimensional bar codes. Most QR codes have a byte representation mode, which provides a mechanism for representing byte streams. No matter what kind of language, they are stored in the computer in the form of internal code, and the internal code is bytecode. This allows to try to convert a variety of language information into byte streams, which are then represented by QR codes, providing an unprecedented way to represent multiple languages in bar codes. Since QR codes can represent byte data and many images are stored in bytes, it is possible to represent an image (photograph, fingerprint, etc.) with the barcode.

QR code can introduce encryption mechanism. The introduction of encryption mechanism is another advantage of QR code. For example, when using QR code photos, it can first encrypt the image information by using a certain encryption algorithm, and then use QR code representation. When recognizing a QR code, the represented photos can be recovered using a decryption algorithm. This will prevent counterfeiting of all kinds of documents or cards.

IV. HOW CAN QR CODES BE USED TO MAKE PAYMENTS

There are three main payment methods for QR code payment:

A. Paying merchant with QR scanners

The customer opens the QR scanning application and displays the unique QR code to the merchant. The merchant will use the mobile payment application to scan the QR code to identify the customer and deduct the money from their mobile wallet.
B. Paying merchant without QR scanners

In this case, the merchant displays the QR code to the customer and the customer will scan it by using the QR scanning application on the mobile device. The app will identify the merchant. The customer then enters the payable amount and finishes the payment.

C. Paying individuals

This usually happens between private individuals. For example, when someone need to pay taxi fare upon drop-off or rent to their landlord. In this case, both payer and the recipient open the QR Scan payment application. Payer will scan the recipient's unique QR code, add the payment amount and complete the transaction.

V. QR CODES PAYMENT PRINCIPLE

QR code payment is a form of mobile payment. As the most important part of e-commerce, mobile payment directly involves the capital security of users and related parties. Therefore, payment security is one of the key issues in mobile payment. QR code payment is a payment method that remote access to the payment system by using QR code, and then submit payment instructions. [5]

A. QR code payment system architecture

QR code payment is very similar to the other forms of mobile payment, and there are two differences.

First, access to pay content platform and access to payment systems are completed through the payment client App. The payment client App is installed on the mobile phone application, with the ability to read, generate QR code and complete payment. The mobile terminal is not a direct participant in the payment process and only provides an installation environment for the payment client App.

The second difference is the way the payment system is accessed. The QR code payment access payment access system by parsing the URL in the QR code or using the QR code as the electronic payment voucher. The payment client App generates a payment instruction, which is submitted by

payment access system to the backend transaction system and the settlement system for processing.

B. QR code payment transaction process

The main difference between QR code payment and general mobile payment is the use of QR code and the generation and transmission of payment instructions. Once the payment instruction is entered into the payment access system, there is no essential difference between the QR code payment and other mobile payments. Therefore, the analysis of the security of the QR code payment technology focuses on the payment instructions before entering the payment system.

By analyzing and researching the commonly used QR code payment software, it is found that the QR code payment can be divided into two types: one is QR code for payment, which appears in the process when the payment client App sends payment instructions to the payment access system. It may be a payment request or a payment certificate. The other is the QR code of goods, such QR code appears in the visit to the payment platform. The QR code of the commodity used by the payment client platform to access the payment content platform does not belong to the QR code payment category, because only the URL of the commodity sales address is stored in the QR code of the commodity, and it has no relationship with the payment access system.

QR code payment has two modes, one is active mode, one is passive mode. In the active mode, the payer uses the QR code reading software built in the payment client App to scan the QR code containing the payment link for payment.

The QR code includes the payment access system URL and the access parameter, and the payment instruction is initiated by the payer. In the active mode, the payer requests the payment system by using the payment client App and generate the QR code payment receipt [6]. The buyer can scan the QR code to obtain the payment voucher and issue a payment instruction to the payment access system to ask the payer to pay. The payment instruction is initiated by the payee. The QR code contains
payment credentials, which can be a string of numbers or other information.

In the active mode, when the user starts to pay with the QR code, it needs to open the payment client App and scan the payment QR code. The payment client App scans and reads the payment QR code, and the user confirms the payment amount and other information on the cell-phone interface. After the payment instruction is confirmed, the payment instruction is accepted by the payment access system. After the payment system processes the payment request, payment client App will display the payment result.

Passive mode of QR code payment process: the payment user first opens the payment client App, requests the payment system from the payment client App, and the payment system sends the payment code to the payment client App. The payee scans the payment QR code on the payment phone of the payer. The payment QR code is recognized and read, the payee submits the payment request to the payment system, and the payment access system requests the payer to confirm the payment request. After confirmation, the payment client App confirms the payment to the payment access system. After the payment system processes the payment request, the payment result is fed back to the payer and the payee.

Compared with the payment process of payment in active mode, the main difference between passive mode QR code payment is that in the passive mode QR code needs to send the payment code to the payment system to generate the payment voucher. The payment voucher is an important parameter when the payee issues a payment instruction to the payment access system.

VI. The development status of QR code payment in China

QR codes are similar with one-dimensional bar codes and are widely used in commercial activities, especially in industries such as high-tech industries, storage and transportation industries and retail industries. In some countries and regions such as Japan, QR codes have become quick and easy ways to communicate information in daily life. In some U.S. and Canadian provinces and in countries such as Hong Kong, the PDF417 code has been used as a badge for identification and printed directly on ID documents for quick reading.

According to the report of “New York Times” in July 17, 2017: “Almost everyone in major cities in China is using smartphones to pay for everything, and China has stepped into the 'cashless era.' While three years ago, the Chinese paid the deal mainly in cash. [7]

The report of “National Business Daily” shows that the proportion of information technology among the scientific and technological fields contributing to "sense of gain" is as high as 61%, surpassing that of the other four areas. Among them, the QR code payment ranked first with a ratio of 26.91%, indicating that QR code payment which are changing people's daily lives, "perception" is high for Chinese ordinary people. [8]

The report said that the development of QR code payment not only brought convenience in the payment method, but also promoted the rapid development of online shopping, sharing of bicycles and other fields. These are also changing the consumption and living habits of the Chinese people, bringing a real "sense of gain" to the people.

Mobile payment has brought a lot of convenience to people's lives, more and more people do not need to carry a wallet when going out, they can easily pay by using phone. In 2016, 22.8% of users used QR code payments daily, and up to 60% of users use QR code payment weekly.

VII. Why QR code payment develops well in China

A. No special equipment needed

QR code generation only need software, and there are many free online software. QR code payment is easy to use for both consumers and merchants. Quick payment has two prerequisites: a standard information terminal and input and output devices. For payment convenience, it is necessary for the equipment can be carried around, the phone has this feature naturally and is almost stuck in the hands of consumers, for consumers, the phone does not necessarily support NFC but must have a camera. As
long as customers have a camera on their phone, they can pay by scanning the QR code. For merchants, they only need to print a QR code without the purchase of specialized equipment, and it is zero-cost.

Compared to the traditional third-party payment terminal POS machines, a POS machine equipment price is as high as 1,000 yuan. For some merchants, this is a high cost. Therefore, many small stores do not support credit card payment, but support the QR code payment.

A similar technique to QR code payment is Near-field communication (NFC), which is adopted by Apple Pay. NFC is faster than QR code payment, but why NFC is less popular than QR code in China? There are two reasons:

1) The first reason is the cost of the chip. For NFC, it needs to be equipped with an NFC chip on everybody's phone. The cost of a chip is a few dollars, so a phone equipped with NFC may spend tens or even hundreds of millions of yuan on this item. Many mobile phone manufacturers are not equipped with NFC function in their own phones.

2) The second reason is the problem of debugging of NFC equipment. NFC debugging is also a big issue. Besides, public transportation varies from place to place, and the POS machines in various businesses are not the same [9]. They do not necessarily support the NFC function. Debugging not only takes a long time, but it also costs a lot of money.

Apple Pay is an example of using NFC. It only supports IPhone 6 and IPhone 6S or later, and the system needs to be upgraded to IOS 9.2 or later. Secondly, there are many tedious verifications in the process of attaching a card, and various problems in POS machines during the operation, it is easy to reduce the user's preference for Apple Pay and it is almost impossible to develop habits.

B. More convenience

People don’t need to enter the details of the person they are paying, just scanning the QR code will identify them instantly. People can make payments using QR codes from any location with only a few taps on the mobile device. In the past, people need to carry a lot of cash with them, they sometimes may receive counterfeit money. After bank card payment appears, people need to bring a bank card at any time. And now, people don't need to take a bank card, they only need to bring a phone, they can easily pay by scanning the code. It is indeed a good way to pay. For some young people, it is convenient, they do not need to bring a bag and do not need to take a wallet when going out.

C. Increased safety

Storing your payment details in your mobile phone and carrying it around is much safer than bringing your entire wallet full of cash and credit cards everywhere you go. The chances of theft and fraudulent purchases using your payment details are much less with QR codes.

D. Customer habits

Consumer habits are an important factor in the rapid development of QR code payment in China. Meanwhile, it also hindered the development of QR code payment in the United States and other countries.

First, compared with European and American countries, Chinese people prefer to use cash. In 2006, cash in circulation in China accounted for about 13% of GDP, compared with 6.4% in the United States and 3.5% in the United Kingdom. Europe and the United States banks have been developed for hundreds of years, bill payment has become an irreversible and deeply rooted national payment habits. In China, Bank of China Zhuhai Branch issued its first credit card in 1985.

Second, due to the imperfect credit system, the payment which rely on credit is difficult to rapidly develop in China. Chinese have an average of 3.6 debit cards, but only one-third have credit cards. This unbalanced situation has created a foundation for the growth of mobile payments because consumers have no fixed credit card and check payment habits so that Chinese people can adapt to mobile payments more quickly. Many people enter the era of QR code directly from the cash age after having a smart phone. The user experience is promoted large enough to rapidly increase the number of users who are willing to use the new
payment method. There are so many consumers who are willing to use the new payment method, which aroused the attention of businesses, coupled with the cooperation of all parties, which makes the popularity of China's code scanning so fast.

In addition, in developed countries in Europe and the United States, credit card payment has been for more than half a century away, and the history of checks has been for centuries. In 1952, Franklin National Bank of California issued the first bank credit card. The earliest check was used in North America as early as 1659. Until today, credit cards and checks are still the main form of payment in Europe and the United States. Decades of credit card and POS systems have largely restricted the promotion of more advanced mobile technologies.

Any one of the payment technology wants to be widely accepted by society, it can not be separated from the consumer and business of these two factors. On the one hand, no matter how much consumers want to use this payment technology, they must also have correspondingly supported businesses. Conversely, if the merchant is merely providing a platform, but the paid experience is not greatly improved, consumers will not change their user habits. In other words, anyone who wants to introduce a means of payment in the market will inevitably seek to work together from both the business and the consumer.

That is the problem of QR code payment and other mobile payment system. In the United States, the large and medium-sized businesses based on POS have been fully used to the consumption of credit card system for decades. For them, the difference between users' experience of paying by mobile phone and paying by credit card is not big, the fees may be different, but they do not have much incentive to offer new payment methods without additional funding. From the consumer's point of view, using technologies such as QR code payment or apple pay in places where credit cards are available, user habits need to be changed, but the improvement of user experience is not much. In places where people can not use a credit card, the use of apple pay is almost impossible, so a vicious circle, consumers have no incentive to use new technologies, businesses are not motivated to provide new technologies. All the power to promote new technologies comes from companies that issue new technologies (apple, google, sumsang, etc.), that spend huge sums of money on merchants and advertisements to consumers, and it's easy to see that such technology can not be rapidly popularized.

E. Attitude to the unification thing

In China Alipay and Wechat Pay dominate China’s mobile payment sector. This is impossible in America. Historically speaking, Americans have great fear, exclusion and resistance to those unifying and super-powerful things, from the big government to big corporations. In other aspects of everyday life, many Americans also do things based on a loose (open) agreement. Communication tools such as WeChat and Facebook are closed and uniformed: Only two people have installed WeChat, so they can communicate with WeChat. For another example, A transfer some money to B. When they transfer money with WeChat, it requires both sides are using WeChat. However, in the United States, the two most common types of money transfers (checks and ACH transfers) are based on an open agreement: With ACH transfers, providing the account number and routing number is sufficient. The two sides that pay and receive money do not need to be in the same bank.

Why this will have a profound impact on the development of the payment form in China and the United States?

For instance, many people say WeChat payment is very convenient, even hospitals, utilities, government departments have supported the WeChat payment. This is hard to happen in the United States. First, both WeChat and Alipay are products of private companies. If a government department or public utility unit supports WeChat and Alipay payment, or if a government agency provides a service using WeChat, then there is the suspicion of private use of public goods, there is a suspicion that the government endorses private companies. Chinese people find it hard to understand the weight of this suspicion. The Chinese people may think this is a very good thing. It is the state's support for the industry. However, the views of the Americans are
not the same. Americans are particularly concerned about separating the public from the private. If there is any suspicion, some people will question it. In the long run, everyone is very careful. And if government departments support WeChat and Alipay, PayPal will say why you do not support PayPal, and other companies will also question or even litigate. Now the US government departments support these payment methods: credit card, cashier's check, ACH transfer. These payment types are based on public agreement, there will be no endorsement of the suspicion of private companies.

The closed property of WeChat and Alipay will be a taboo for Americans. In the United States, proprietary things are basically not big. For example, BBM on Blackberry, Apple's iMessage, and WhatsApp now have not reached the monopoly level of WeChat. A very important reason here is that Americans do not like monopoly things, do not like to be forced to use something. If you tell Americans that you have to install WhatsApp, many Americans will soon have a little resistance in their hearts. This deep resistance, in turn, has prompted many Americans to engage in open protocols and ecosystems because they do not want to be forced to use one piece of software or to force others to use one piece of software.

F. Company’s effort

QR code payment can be widely used in China, one of the most important reason is the company’s effort to provide information, advertising, promotions, which promote positive attitudes towards QR code payment [10].

WeChat, Alipay did a very good job in promoting investment and marketing activities, and establish a lot of use scenarios. They offer users a large number of discounts and subsidies in a wider payment environment, which can take the initiative to cultivate user habits.

Subsidies are a very effective way to develop user habits. During the promotion phase, WeChat and Alipay deployed large-scale subsidies to deploy QR codes in almost all key areas of major cities in the country and subsidized users through various online and offline promotions. They give users a lot of discount subsidies, many online App have a discount, if user pay by WeChat or Alipay payment.

These companies also have helped to increase the efficiency and quality of government public services. Take Alipay for example. At present, 357 cities in 31 provinces (districts and cities) have settled in Albania's "city service" and have realized the QR code payments for public services, including paying utilities, paying traffic fines, paying for public transportation and online registration of the hospital and so on. People used to go to the relevant office to do these things, and now they can do it without leaving home.

Whether it is business or consumer, mobile payment not only makes payment convenient, more importantly, the payment also gives the merchants other functions. Take Alipay for example. When people pay for a business with Alipay, Alipay's client will show the corresponding business information, if the consumer follow the public number of the business, it will become a member of the business, they can receive the relevant promotional information. In other words, instead of just using a payment method, merchants can use Alipay to build a link between merchants and users through this payment method. This is a function that traditional credit card payment does not have. Alipay has become a bridge to communicate users and businesses.

WeChat and Alipay also have a built-in function “red envelopes”, red envelopes is a Chinese New Year tradition, red envelopes means the lucky money. Now Chinese people are sending virtual red envelopes to their relatives and friends through WeChat or Alipay during the Chinese New Year or holidays. This greatly enhances the popularity of Alipay and WeChat.

Alipay and WeChat also provide the function of instant transfer within the platform, which is the key to the rapid development of third-party payment platform. The transfer function of the third-party payment platform is the key to rapid development of various types of comprehensive financial services (red envelopes, collection of money, and repayment for the credit card) of third-party payment platforms. Consumer's transfer needs in the mobile payment
accounted for a very high proportion, which promote the platform.

However, what did their competitor do? Apple Pay just cooperated with the bank. In the initial promotion, it did not invest a lot money both online and offline. In the online promotion, Apple Pay does not have the "Red Envelope Advantage" of WeChat and Alipay, nor does it provide users with substantial concessions and subsidies. In the offline promotion, Apple Pay only focuses on high-end consumption scenarios such as Starbucks, 711 and KFC and it ignored the small business.

G. Other reason

Of course, QR code payment can be popular in China, it has a great relationship with China's special national conditions and China’s population.

QR code payment can not be without a bank card, regardless of deposit card or credit card. In China, opening a full-function bank deposit card is the most convenient in the world. As there is no threshold (even though you do not have a job) and account opening is free and people can get card in real time. Most Chinese have at least one card of four state-owned banks. As many public benefits involving social security, subsidies and so on are directly linked to state-owned banks, for example, rural subsidies are directly transferred to the agricultural bank card of each farmer. This ensures that the state-owned banks can cover all the areas, whether economically developed or underdeveloped.

WeChat or Alipay, want to carry out mobile payment services in China, the first thing need to be resolved is to reach a payment agreement with the bank, and the four major state-owned banks basically covering 99% of Chinese, as long as the four banks get solved, the problem is solved. What is needed for mobile payments is a highly centralized financial system. The superb coverage of large state-owned banks has allowed Alipay to grow from start to grow, with only needing to support a small number of banks. In 2017, Alipay only support about 150 banks in total.

According to the statistics of the US Bank Location website, there were 5,796 public banks and 90,833 bank branches in the United States in 2017.

The top 10 U.S. banks only hold 32% of the total number of outlets. In addition, the United States has more than 1,000 non-bank deposit-taking institutions and about 10,000 credit unions. Not to mention building mobile payment platform more difficult, just the high cost of inter-bank transactions is a huge obstacle. The cost, efficiency and risk are not an order of magnitude in four interbank settlement and settlement between nearly 6000 banks. This is a big obstacle to the mobile payments business in the United States.

China's population has a huge advantage in popularizing new technologies. In Denmark, with a total population of more than 5 million, even if a good new technology initially occupied 10% of the market, it is only 500,000 users, such a base would hardly support a new company in continuing to create new, affordable and easy-to-use technology. But it can be seen in China, with the advent of promising new technologies, such as mobile payments, shared car, takeout software, and sharing of bicycles, even if the money is lost, big companies are willing to continue investing in the early days. Because the market is too large. This is one of the reasons why Denmark, a country where bicycles are far more used daily than China, can not achieve public bicycles and share bicycles, because Denmark does not have a population density of Chinese cities.

VIII. Security

At any time, the security of funds is a very important issue. If the QR code payment is not safe, no matter how convenient and fast, no one will use it, so here it need to discuss security issues under Chinese QR code payment.

A. Security requirements for QR code payment

As a special form of mobile payment, QR code payment has similar security requirements as mobile payment. In the mobile payment process, from the perspective of the transaction process, its basic security requirements include verifiability, privacy, integrity, non-repudiation, etc.

1) Authenticity: since the main process of QR code payment is carried out in a network environment, both parties of the transaction transfer funds through the payment system and the
Identification of the parties to the transaction is an important part of mobile payment. If lack of certification in the transaction process, then hackers can easily cheat sensitive information and financial fraud by forging identity. Certification is the identification of people or entities identity to provide a guarantee of authenticity. The parties to the transaction can confirm each other's identity with or without meeting. There are 3 authentication methods in mobile payment.

- The principal uses a key which is only shared with the verifier to encrypt the message. The verifier uses the same key to decrypt the identity of the principal.
- The principal signs his message using his private key, and verifies the signature using the principal's public key to verify the principal's identity.
- The subject proves his identity through a trusted third party.

2) Confidentiality: from the perspective of the QR code payment process, there are multiple data exchanges between the payment client App and the payment access system, and the data may be related to the user's identity, payment instruction and payment voucher, which are sensitive information of the transaction process. Once leaked it may be used for illegal trading and lead to the QR code payment system user's identity information leakage or financial losses. QR code payment is based on an open network environment, maintaining the confidentiality of sensitive information in the transaction process is an important guarantee for secure transactions [11]. Therefore, to prevent sensitive information from being illegally accessed and stolen, in mobile payment, encryption is generally used to ensure the confidentiality of sensitive data.

3) Integrity: Integrity can generally be obtained by extracting the message digest of the message. First it need to generate a digest by using hash function, then attach it to the message as the basis for verifying the integrity of the message. After receiving the message, the receiver of the message generates a digest with the same hash function and compares the received digest to determine whether the message is complete.

QR code payment brings convenience, but also brings the problem of maintaining the integrity and unity of all parties involved in the transaction. For example, the transaction data changes in the transmission process, resulting in the different payment information being seen by the parties to the transaction. In addition, data may be lost, duplicated, or the order in which information is transmitted is altered during the payment process, which may result in different information being seen by the parties to the transaction [12]. Maintaining the integrity of the parties involved in the transaction is the basis of mobile payments, and therefore it requires integrity measures to prevent the random generation, modification and deletion of information, while preventing the loss and duplication of information during data transmission and ensuring the order of information transmission.

4) Non-repudiation: In the QR code payment, all the payment information exists digitally. Compared with the traditional paper voucher method, the digitized information is more easily modified and forged. In order to prevent the data being modified or faked as an excuse, traders denied participating in trading activities, the transaction information needs to be added to the trader evidence of participation in the transaction, that is, non-repudiation. Non-repudiation evidence is primarily provided by digital signatures in mobile payments.

B. How Chinese company solve the security problem of QR code payment

The security of QR code payment is solved by the following two aspects: the first is the authentication when the QR code payment function is opened, the second is the generation mechanism of QR code.

Although now the phone number is opened with an ID card, bank card is also ID card to open, but third-party payment platform itself can not confirm the corresponding relationship between the phone number and bank card by ID card. This work can only be conducted in the face-to-face manner by the bank. That is: 1. The bank verifies the phone number at the time of card opening. 2. After card opening,
add / modify the certified cell phone number separately (people must be present and verified through the identity system with the Public Security Bureau, after the information is passed, it can be completed). This means that people grant the appropriate mobile phone number transfer permissions through his on-site permission, so as to ensure safety. The job was apportioned to the day-to-day work of more than 220,000 commercial banks across the country. This purely human input is unrealistic for other countries’ financial institutions.

In the early stage of the development of the QR code, the QR code payment is an active payment for the user. The user finishes the payment by scanning the QR code provided by the business (or person). In this process, the user is incapable of intervening or discerning the generation of a QR code. This mechanism allows hackers can easily implant Trojans, this payment does exist a great security risk, and hackers can generate Trojan horse embedded QR code with almost no cost.

The current QR code payment method can be understood as a passive payment method. The QR code (or barcode) is generated by the user himself or herself. The merchant scans the user's QR code (or barcode) to complete the payment. Such a change made the entire payment much safer. The QR code is generated by the user himself, which controls the generation of the QR code at the source and greatly improves the security. Payment code has timeliness, payment code is a one-time generation, timeliness is one minute, after the scan by the merchant will be invalid. Besides, a payment code can only be successfully paid once, repeatedly being scanned will not be repeated chargeback.

On the other hand, the payment codes of Alipay and WeChat, require merchants to be certified or contracted, which controls the scope of the flow of funds and further limit the scope of the risk. The payment code itself is a series of numbers, does not contain sensitive information, business code scanning will not disclose the user's account information. These companies done a lot of work on code scanning technology, for example, the payment code has anti-screen mode to prevent crooks to induce users to share screenshots. In addition, when scanning code, the system will detect whether the QR code contains Trojans to protect the safety of the user's phone.

Alipay and WeChat have done a lot of work to make QR code payments meet all security requirements including verifiability, privacy, integrity and non-repudiation.

IX. DISCUSSION

According to Liébana-Cabanillas’s research, “attitude, innovation and subjective norms are determinants of the user’s intention to use QR code payment [10]. Through the above analysis, it can be seen that the QR code payment greatly enhance Chinese user’s experience. QR code payment of Alipay can have a great market, is based on the popularity of Ali and other e-commerce platform of Taobao. WeChat is a monopoly social platform, which has a good social demand orientation. And they have done a lot of innovative activities to win the trust of consumers and successfully attracted consumers, which makes China's users have a good attitude towards scanning code. This is the reason that China's code scanning can rapidly develop.

X. CONCLUSION

QR code do not need special equipment, it is convenient, it also increases safety. Chinese user’ experience is promoted large enough by using QR code payment. China has unique QR code payment environment, besides, China's third-party platform has made a significant contribution to the popularity of QR code payment and well handled the security issues of the QR code payment.

This paper mainly talks about the reason why QR code payment develop well in China, but over the past year, QR code payments have developed very much around the world.

“The Asian Banker” reported that “In 2017, India launched the Bharat QR, which is called the world's first fully interoperable QR code payment. It is developed by the India national payment company (NPCI), MasterCard and Visa. It overcomes the limitations of the closed loop QR code-based acceptance.” This is a new model for interoperability.
In the future work, the research will focus on the development trend of QR code payment.

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