

Utilization of QR Code for Tracking Digital Expenses

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Abstract — Today, a lot of us have a lot of digital wallet services that we use. Because of that tracking our spending has become significantly harder because most people use more than one digital wallet. This study aims to find out how can we utilize QR code in the payment receipt at out digital transaction, to keep track on our transaction on various digital wallet. To help keep track of the expenses from the various digital wallet, we use QR code that is generated from the receipt of the transaction that contain the encrypted data of the transaction that occurs. This data can be scanned so it can be added to a personal budget tracker app so the user can manage their digital expenses in one view.

Keywords: digital wallet; QR code; digital expenses

I. INTRODUCTION

Indonesia ranked 5th among the countries with the largest mobile payment service development (Davis, F. 2019) as seen in figure 1. However, its financial literacy index is only 32% (Klapper, et al. 2015) and ranks 85th of 144 countries. In addition, 4 out of 5 Indonesian gadget users use their smartphones to buy some goods online and 54% respondents are tempted because of the coupon and discount offers (GlobalWebIndex, 2019).



Figure 1. Mobile Payment Growth in Several Countries (Source: Davis, F. 2019)

Apart from purchasing things from e-commerce site, a lot of merchant has already accepting payment via digital wallet or e-wallet application. Those application use QR code as a link to the transfer fund section of the seller’s account to accept payment. Per February of 2019, GoPay already reached 63 billion US\$ of transactions (Fadila & Annisa, 2020). That number shown how much e-wallet has been accepted as a part of Indonesian life.

Most of digital transaction through e-wallet payment, use QR code. QR Code has become an effective alternative which can be accessed through any smartphone that support them. It is easy to use, instead of reaching their pocket and looking for cash or card, customer can just scan the QR code and finish their payment with an ease. Making transaction via e-wallet increased from year to year.

Some of these factors can be a positive thing for the country’s economy, but on the other hand, it can have the opposite effect on individual financial conditions. The number of applications installed separately can make it more difficult for them to monitor their financial flow regularly. They must scroll to a lot of application on a day to day basis to track their expenses. Under these conditions, an idea emerged to create a system that could facilitate anyone to supervise the expenses through mobile payment with QR code technology.

1.1 Related Works

Financial management is an essential skill for everyone to avoid financial crisis. Many people still have low financial literacy, this statement is backed by (Amidjono, et al. 2016) findings that found the level of financial literacy in Indonesia as a whole still low. That is why (Morgan, et al. 2019) suggest a clear definition must be made about what is financial literacy so the government can provide a better education for their people. Nowadays,

(Dikria & Mintarti, 2016) observe that many poor financial managements careless use of credit card and poor financial planning. On a student the example is buying unnecessary things and unconsciously spend all the money that they have. According to (Hidayatullah, et al. 2018) online commercial can affect a person's lifestyle to become more consumptive. This theory is aligned to (Nuriyanto, et al. 2019) theory that confirm consumptive behavior can be affected by the culture, and the psychological state of a person.

To overcome this, it is advisable for every to person to keep track of their finance to prevent overspending their money. But nowadays lots of thing can make a person lose track of their finance (Lewis & Perry, 2019) said that consumer can lose track of their finances because their money is being spent and stored through many different digital platforms. It is also difficult to gather the information that is spread across many platforms. Other than that (Kumala & Mutia, 2020) the chances of a miscalculation to happen when trying to keep track large amount of money is high if done manually and suggest to use a software that can save time and prevent error in managing finance.

(Tiwari, 2016) explains that Quick Response Code or QR Code for short is a 2-dimensional barcode that can store data that designed to be read from a mobile device. QR Code is made by Denso Wave in 1994 to keep track of sparepart inventory on the warehouse.

According to (Baskoro & Amini, 2020) the main factor that affect people to use QR Code for mobile payment is the simplicity and the ease of use. (Petrova, 2016) also said the benefit of QR Code is the tool to use it has already spread to the community. QR Code is easy to use, user just need to scan it and they can immediately see the contents of the QR Code. But QR Code is also dangerous because a QR Code can be easily replaced with another QR Code that can direct user to malicious site. That is why (Petrova, 2016) recommend user to be careful with their when scanning QR Code and protect their device with antivirus to protect it from the thread that might come.

Even though user feel safe using QR Code, there are still chance that something bad might happen. (Purnomo, et al. 2016) state that mobile transaction can have various risks that can happen. The same thing was stated by (Mohit, et al. 2017) that is why a system that guarantees the user safety is needed for mobile payment. According to (Purnomo, et al. 2016) a security system can be made by using an encrypted QR Code that use special authentication method for the user. For every QR Code transaction that occurs, the system will always check the public and encrypted private key generated by the merchant to be received by the correct user because the decryption system can only be done on one connected network channel. If the QR Code reaches the correct user and the decryption system is running, then the data inside can be read by the reader. The time limit for public and private keys in the QR Code is very limited. If the user does not confirm within the specified time limit, then the QR Code will expired. What is stated by (Mohit, et al. 2017) is different from (Purnomo, et al. 2016). The procedure stated is as follows; The user starts the transaction by sending a temporary identity to the merchant. Throughout the entire

transaction process, users can communicate directly with the merchant if both peers are also equally communicating with the bank. For communication with the bank to run simply, both the user and the merchant need a payment gateway.

Another method that is stated by (Lu, et al. 2017) is by stacking the original QR Code with random shadow patterns or certain images which will then generate a new QR Code that has been encrypted. According to (Lu, et al. 2017), this method itself has 3 stages in producing encrypted QR Code, which is to produce the first shadow, then continue to produce the second shadow, and the last is to combine the original QR Code with 2 shadows that have been previously generated. In producing both shadows, the author uses a secret pixel which is the breakdown of a pixel into 2 parts, namely black and white blocks. To decrypt the encrypted QR Code, the process that was passed was carried out in reverse. However, to do this the user must be connected to the same cloud server as the producer of the QR Code so that the decryption algorithm can be performed. Another method proposed (Sun, et al. 2019) is to encrypt the QR Code through the Public Key Infrastructure (PKI). When using the QR Code, the user will first send the user ID to the merchant who will then send a public key request to a third party (payment service provider). This third party then generates a public key and private key based on the ID sent by the user. The public key that has been generated by the third party is sent back to the merchant, while the private key is authenticated and then sent back to the user. After that, the merchant will generate a QR Code from the user's public key that he has received from a third party. The last process is the user scans the QR Code generated by the merchant and then decrypts the QR Code with the private key it receives from a third party and will verify the message received.

Different from the previous security methods, the method proposed by (Oo, K. Z. 2019) includes a wider scope. The security method written (Oo, K. Z. 2019) is not only based on the QR Code, but more on the implementation of Electronic Payment Gateway. First, the system will generate Rivest-Shamir-Adleman (RSA) private and public keys which will then enter the database key. After the user enters the card information, the system will receive the user's card information and proceed to the decryption process using the merchant's private key from the database key. After going through the decryption process, information on the card will be validated with data on the card database located on the server. If the validation is successful, the system will re-encrypt the user's card information using the bank's public key from the database key, the process continues to enter the bank, and after the process is complete, the user will receive the results of a successful payment. However, if validation fails, the user's payment will fail.

(Widayati, 2017) said the QR Code usage has been universal in various fields. (Mawarrini, 2017) assumes that the mobile payment industry players mostly use QR Code technology. The implementation of payment systems is extensive, for example; the use of QR Code payments on mobile banking services that were put

forward (Karmawan, 2019) and the use of QR Codes on the Smart City Bus application put forward by (Fong, et al. 2019). In (Kumala & Mutia, 2020) it is said that electronic money (e-money) is one kind of digital financial products. E-money is considered as a more effective alternative non-cash payment. Electronic money is stored in a digital wallet for easy access. In (Huang, 2017) the QR code is used as a medium for mobile payments, where the user only needs to scan the QR code, writing down the nominal to be sent. Because the convenience provided by the QR code is very helpful in the development of mobile payment. There are (Saragih & Wagiu, 2019) that found QR Code can be a solution in overcoming the problem of manual financial records and finding out the readiness of users in controlling finances. Therefore, with this system, forgetting to record sales results can be overcome because the recording is done directly or real-time in the system.

II. METHODS

The method used in this research goes through two stages: to conduct study if our model can be useful for tracking personal expenses and to designing the algorithm for tracking digital expenses.

2.1 Literature Study

In this study, an observation is conducted to find the factor that can help a person to manage their personal expenses. The idea of this method is to define the technological relations in personal financial management. In addition, to find out how far the current implementation is and how far can utilize the technology for certain needs.

QR code is used in this technological method because its popularity and capability in storing various kinds of data compared to barcode. In addition, the security side of the QR code is also better. For that reason, the QR code is used for personal purposes such as managing financial expenses digitally. This is to facilitate the user because it can be done by simply scanning the QR code without the need to input expenses data manually.

2.2 Method Analysis

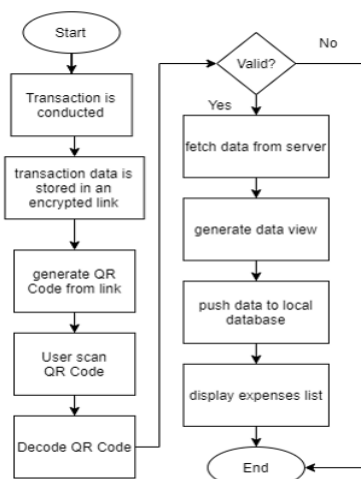


Figure 2 Algorithm Flowchart

As seen in figure 2, the sequence begins when the transaction start, the important data from the transaction then stored to an encrypted link that can only be opened by the authorized user. Next, the QR Code is printed on the payment receipt that the user received. After that, the user must open the application and scan the QR Code with the scanner that came from the app. The QR Code is then decoded by the scanner. The data is then being validated and authorized by matching the registered user in the transaction and the user that scanned the QR Code by the system. If the QR Code is not valid or is being opened by a different user, the algorithm immediately ended, if the QR Code is valid and the user is authorized then the algorithm begins to fetch data from the server to define what kind of data view that must be generated by the algorithm. The user then must choose to proceed to continue so the data can be pushed to the local database. After that the algorithm will show all the expenses list in the last month so the user can check the expense history.

III. RESULT AND DISCUSSION

Based on the study that we conducted, QR Code is a good media for this algorithm because of the immense popularity that it has and most people already familiar of how it works.

For the algorithm, the design for the actual application is not present yet, but the overall function of the application is already well thought. This algorithm is made to make tracking digital expenses much easier by collecting all transaction data in one platform.

Besides the algorithm design, there is also data contained in the QR code and data that will be obtained by the user after receiving a response request from the server as seen in table 1 and table 2.

Table 1 Data inside the QR Code

Data Name	Data Type	Length
Server URL	STRING	50 characters
API Key	STRING	16 characters
Transaction ID	STRING	8 characters

Table 2 Fetched Data from Server

Data Name	Data Type	Length
Transaction ID	VARCHAR	8 characters
Items Name	STRING	50 characters
Unit Price	DECIMAL	
Quantity	INTEGER	
Total Price	DECIMAL	

IV. CONCLUSION

In this study we already presented a way to use QR Code for tracking personal digital expenses that will help user that use digital wallet for their transaction to manage their expenses easier. The benefit is it provide a place for tracking all of their spending in one place and easy by scanning a QR Code.

And we choose QR Code because the use is already widespread among the communities so user can familiarize themselves better. That is why for this study we explored a new way of using QR code that can help a lot of person managing their personal finance. To help users that use digital wallet as media of transaction, it can provide a great benefit that they can track their spending clearly with just a scan of an QR code. Then use the app to manage their finances so they can manage spending easily without any hassle.

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