Designing the QuickCash Payment System prototype by using cash withdrawal services through minimarket as an alternative solution for secure money transfer from bank customers to non-bank customers

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Designing the QuickCash Payment System prototype by using cash withdrawal services through minimarket as an alternative solution for secure money transfer from bank customers to non-bank customers

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Abstract. In this era wich has many electronic payment facilities, it is noted that the need for cash in Indonesia is still high and bank customers are still relatively small. This shows that Indonesians need money transfer services from bank customers to non-bank customers. As an alternative to meeting these needs, Alhothaily, et al. put forward a QuickCash payment system that allows bank customers to transfer money to non-bank customers. Therefore, in this study, the prototype design of the QuickCash payment system was made to facilitate the transfer of money. According to Alhothaily, et al. QuickCash payment system is a payment system that makes it easy for users to transfer money. To prove this statement, the prototype design of the QuickCash payment system was built using the SSDLC methodology and tested the QuickCash payment system prototype by collecting data using a questionnaire. Based on the test results with a significance level of 5%, all respondents agreed that the QuickCash payment system made it easy for users to make money transfers.

1. Introduction

In this era, which has provided many electronic payment facilities, it is noted that the need for cash is still quite high [1]. According to the "Global Cash Report" report, 79% of sales points in Europe use cash transactions [2]. While in the same report, it states that 50-55% of financial transactions in Indonesia still use the cash payment method [3]. In addition, in the 2012-2016 period, Indonesia experienced an increase in the number of cash withdrawal transactions at ATMs by 65.5% [3]. However, in the publication of the Indonesian Deposit Insurance Corporation (LPS) in 2015, it was mentioned that not up to 25% of Indonesia's population has a bank account [4]. The number of bank account holders is very small compared to the number of cellular phone owners in Indonesia. The number of cellular phone owners in Indonesia is 142% of the Indonesian population [5]. The statement shows that Indonesians find it easier to access cell phones than bank accounts. Therefore, Indonesian residents need a cash transfer service from bank account holders or bank customers to non-bank customers by utilizing cellular phones.

As an alternative to meeting these needs, Alhothaily, et al. in his research entitled QuickCash: Secure Transfer Payment Systems submits the QuickCash payment system [6]. The purpose of the QuickCash payment system is so that bank customers can make cash transfers to non-bank customers by utilizing cell phones. This QuickCash payment system allows non-bank customers to still be able to use banking transactions without the need to open a bank account or register with a third party service.

In addition, Alhothaily, et al. also stated that the QuickCash payment system makes it easy for users to make money transfers. Therefore, in this study design, a prototype of the QuickCash payment system was carried out as an alternative solution to transfer money from bank

customers to non-bank customers and show whether the QuickCash payment system makes it easy for users to make money transfers when applied in Indonesia.
The prototype design was carried out by utilizing a cash withdrawal service through a minimarket as a substitute for the role of ATMs in the QuickCash payment system. Cash withdrawal services through minimarkets were chosen because the number of minimarkets is increasing and has spread throughout various regions in Indonesia [7]. In addition, the minimarket also has a money transfer service without an account that is already valid in Indonesia [8].

2. Method and materials

2.1. QuickCash payment system

QuickCash is a payment system that consists of three main phases as shown in Figure 1 namely the transaction request phase, the transaction initialization phase, and the verification phase [6]. The QuickCash payment system consists of two different schemes based on the verification factors used. The two schemes are QuickCash Online and QuickCash Offline. QuickCash Online utilizes Virtual Account Number (VA) and One Time PIN (OTP) as its verification factor, while QuickCash Offline utilizes QR code and Personal Identification Number (PIN) as verification factors.

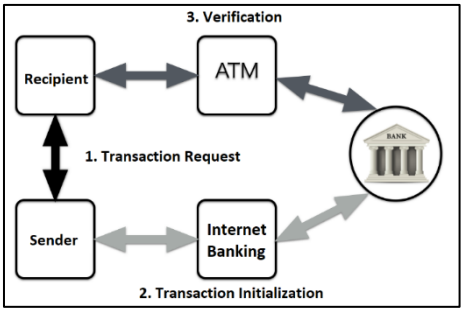

Figure 1. QuickCash payment system overview [6]

2.1.1. QuickCash Online

Following are the phases of the QuickCash Online transaction:

a. Transaction Request Phase
   In this phase, R (Recipients non-bank customers) tells T (Amount transaction), m (Recipient's telephone number), $ATML$ (ATM Location), and TVP (Transaction Validity Period) to S (Sender bank customer) to make a transaction.
b. Transaction Initialization Phase
   The following are the steps in the QuickCash Online Transaction Initialization phase:
   1). S login to the internet banking application with the QuickCash Online menu to make transactions by entering T, m, $ATML$, and TVP.
   2). The $BANK$ generates VA based on T, m, $ATML$, and TVP received from S, then sends it to S through a secure mechanism.
   3). S sends VA received from the $BANK$ to R.
c. Verification Phase
   Following are the steps in the QuickCash Online verification phase:
   1). R enters VA at ATM according to $ATML$ during TVP.
   2). ATM sends VA received from R together with $ATML$ to the $BANK$.

3). The *BANK* then identifies *VA* and *ATML* whether it is in accordance with *TVP* and the maximum limit is to do experiments. The use of the maximum limit carried out by an experiment is to prevent a brute force attack before the transaction is canceled.
4). *BANK* sends identification results to the *ATM*. If identified, the *BANK* will send an *OTP* to *R*. If not identified, the *BANK* will instruct the *ATM* to display a transaction failure message.
5). The *ATM* instructs *R* to enter the *OTP* received.
6). The *ATM* sends the *OTP* that has been entered by *R* to the *BANK* for verification. If the verified *OTP* is correct (*OTP* entered = *OTP* sent), the *BANK* will send a verified message to the *ATM*. Otherwise, the *BANK* will send an unverified message to the *ATM*.
7). If a verified message has been sent, the *BANK* will provide dependents on *S* accounts.
8). In addition, the *BANK* will send a notification message to *S* that *R* has withdrawn money from a transaction that was previously made.

2.1.2. QuickCash Offline

Following are the phases of the QuickCash Online transaction:

a. Transaction Request Phase
In this phase, *R* notifies *T*, *ATML*, and *TVP* to *S* to make a transaction.
b. Transaction Initialization Phase
1). *S* login to the internet banking application with the QuickCash Offline menu to make transactions by entering the account number or *VA*, *T*, *ATML*, *TVP*, and *PIN*.
2). All information entered has calculated the hash value using a hash function, Then the hash value is signed by the *BANK* using the signature function and *BANK* private key.
3). All transaction information and signature are encrypted using an encryption function and *ATM*'s e public key.
4). *BANK* generates a QR code containing the results of the encryption of transaction information and its signature.
5). *S* sends the QR code along with the *PIN* to *R* securely.
c. Verification Phase

Following are the steps in the QuickCash Offline verification phase:

1). *R* scans the QR code at the *ATM* in accordance with *ATML* during *TVP*.
2). The QR Code scanner decodes so that the QR Code is read as an encrypted message.
3). *ATM* decrypts encrypted messages using the decryption function and *ATM* private key. The decrypted message consists of two parts, namely transaction information, and signature.
4). The *ATM* identifies the transaction and checks the validity of the transaction signature using the *BANK* public key and verification function.
5). If the transaction is identified and correct, the number of verification attempts is less or equal to the maximum number of attempts, the *ATM* will ask *R* to enter the *PIN*.
6). If verified (*PIN* entered = registered *PIN*), the *ATM* allows *R* to withdraw cash and send the cash withdrawal information to the *BANK*.
7). The *BANK* provides dependents on the *S* account and informs that *R* has made a cash withdrawal from the transaction that has been made.

2.2. Research methodology

The methodology is a general logic flow and theoretic perspectives of a study [9]. In this study, the research methodology used is Design Science Research Methodology. Design Science Research Methodology is a methodology that consists of five process step bellow [10]:

a. Awareness of problems. This is the first step to identify problems. This step is carried out by studying various sources. The result of this step is a new research proposal that contains the initial hypothesis.
b. Suggestion. This is the step of identifying suggestions as a creative step by producing new functionality based on new or existing elements. This step can also result in improvements to the hypothesis that was made in the previous stage. The result of this step is a temporary design based on the proposal.
c. Development. This is a step to do a temporary design that is produced from the suggestion step. The result of this step is an artifact.
d. Evaluation. This is an evaluation of the artifacts in accordance with the criteria contained in the proposal. In this step also contains an analysis of the behavior of artifacts generated based on hypotheses from the characteristics of artifacts.
e. Conclusion. This is the step that ends the research cycle.

3. Result

3.1. Awareness of problems and suggestion

At this stage, the information is collected through a literature study. From the information gathered, an idea was obtained to make cash transfer services from bank account holders or bank customers to non-bank customers by utilizing cell phones. Next, the idea is given suggestions in the form of creative steps to design a prototype QuickCash payment system. Besides that, at this stage a new hypothesis emerged that the QuickCash payment system made it easy for users to make money transfers. In addition, there is another creative step that is given, namely the design of the prototype QuickCash payment system by utilizing cash withdrawal services through minimarkets.

3.2. Development

In this step, the prototype of the QuickCash payment system is made up of three applications based on the creative steps obtained from the previous step. The design is done by running SDLC with the waterfall methodology. Three applications that need to be built, namely the bank application as a bank system application, the internet banking application to access bank services during the transaction initialization phase, and the minimarket application for transaction verification or cash withdrawals that have been determined through a minimarket as a substitute for ATM.

3.3. Evaluation

At this stage, an evaluation is carried out to determine whether the QuickCash payment system makes it easy for users to make money transfers based on a prototype that has been built by collecting data in the assessments questionnaire from respondents who act as prototype users of the QuickCash payment system through a questionnaire.

a. Determine the respondent

The user rating questionnaire is filled in by respondents with the criteria of having an internet banking account and having used the transfer or payor buy feature of the internet banking application. The number of respondents was determined using the formula $n = 0{,}25(Z/E)^2$ [11]. The symbol n is the number of samples, Z is the standard normal number with a value of

1.96, E is the error rate determined at 10%. So the value of n or the number of samples produced is 96.04 samples or rounded up to 97 samples.

b. Designing a questionnaire

At this stage, the user assessment questionnaire was designed which contained six statements, each statement containing the ease of mechanism in each phase of the QuickCash payment system. The rating scale used in this questionnaire is a Likert scale with four answer choices namely "strongly agree", "agree", "disagree", and "strongly disagree".

c. Test the questionnaire

Before the questionnaire was distributed to all respondents, a questionnaire that had been designed was tested for validity and reliability using the SPSS 19 application. The result of the validity test shows that based on the counts obtained, all questionnaire statements were declared valid and the questionnaire was declared reliable.

d. Contact respondent

At this stage, respondents were directed directly about filling out the questionnaire. First, a prototype of the QuickCash payment system simulation was built to respondents. After that, respondents were given a user rating questionnaire through Google Forms to assess the simulated QuickCash payment system. After that, respondents were also asked to compare the QuickCash payment system cash withdrawal mechanism with the ATM cash withdrawal mechanism by using the same method.

e. Analysis of the results of the questionnaire

After the questionnaire results are obtained, the tabulation of the questionnaire results is carried out. In the tabulations that have been made, obtained scores from each respondent.

Next, objective criteria based on the Likert scale are used as follows:

1). Count the highest and lowest score amounts

The highest number of scores obtained is $\frac{4\times6}{4\times6}\times 100\% = 100\%$. The lowest number of scores obtained is $\frac{1\times6}{4\times6}\times 100\% = 25\%$.

2). Determination of the interval

Then the interval calculation is done using the formula $I = R/K$. Rvalue is $100\% - 25\% = 75\%$ and K value is 2 the interval obtained is $\frac{75\%}{2} = 37{,}5\%$.

3). Calculate range standard

After the interval is obtained, a range standard calculation is performed which produces the value $100\% - 37{,}5\% = 62{,}5\%$. So the objective criteria obtained are to agree if the scores obtained $\geq$ 62,5% and disagree if a score is obtained < 62,5%.

After the objective criteria are determined, the score of each respondent is compared with the objective criteria. The result is that each respondent has a score of more than 62.5%. Thus, it can be concluded that all respondents agreed that the QuickCash payment system made it easy for users to make money transfers.

In addition, the results of the cash withdrawal mechanism assessment showed that the average score for the cash withdrawal mechanism at the ATM was 73%, QuickCash Online was 88%, and QuickCash Offline was 89%. Based on the average score obtained shows that the score of cash withdrawal mechanism in the two QuickCash payment system schemes is greater than the ATM cash withdrawal mechanism score.

4. Conclusion

Based on the analysis of the tests that have been done, it can be concluded that the QuickCash payment system makes it easy for users to make money transfers. In addition, based on a comparison of the average user rating score on the cash withdrawal mechanism on the QuickCash payment system and ATM, it is recommended to make a study to compare user ratings of the QuickCash payment system cash withdrawal mechanism with ATMs

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