

E-payment for Jakarta Smart Public Transportation, Using the Point System for E-Commerce

Nizirwan Anwar¹, Roesfiansjah Rasjadin², Daniel Stephanus Najoran³,
Christopher Rolando⁴, Tamimmanar⁵ and Harco Leslie Hendric Spits Warnars⁶

¹Faculty of Computer Science, Esa Unggul University, Jakarta, Indonesia 11510

²Faculty of Engineering, Esa Unggul University, Jakarta, Indonesia 11510

^{3,4,5}Computer Science Department, School of Computer Science, Bina Nusantara University, Jakarta, Indonesia 11480

⁶Computer Science Department, BINUS Graduate Program – Doctor of Computer Science, Bina Nusantara University, Jakarta, Indonesia 11480

*nizirwan.anwar@esaunggul.ac.id

Abstract. The ease of using transportation is one of the most critical things in the city with a significant population like Jakarta. The growth of the population in Jakarta is increased rapidly. The wage that Many transportations are causing a traffic jam in Jakarta. The government suggests that people use public transportation for their mobility. However, people choose to use their vehicles rather than public transportation. The main reason is that public transportation cannot guarantee the arriving time, whether it is on time or not. Many people move on to online transportation services. However, the massive growth of online transportation is still a contradiction as public transportation. People in Jakarta need faster mobility to go. This research is trying to make a system for public transport without any delay and hard to use it. This problem can be solved by building a new system. This system required e-wallet for payment in public transportation. This E-Wallet will search the possible route from the nearest location to the destination — only the public transport where there is a station that can use it. By using QR-Code generated by e-wallet on the mobile phone, people can scan it directly to a machine located in the station. This method will make a transaction faster than ever. Moreover, people can enjoy another feature like cashback and redeem the prize by a point system. In this era, e-commerce is dominating the market for purchasing something. This is also the attraction of the system. This system is also required excellent facilities from the government so that people can enjoy it.

1. Introduction

In the city where there are many people, especially in Jakarta, there are many challenges that people had to face. Quotes from Databoks website, in 2017 the population in Jakarta is about 11 million people. The more community in the city leads people to have more accessibility for their transportation. They prefer to ride private vehicles than public transportation.

For specific reasons, people nearly do not want to use public transportation, with some conditions such as uncomfortable, hard to access, and especially not necessarily on time. Metropolis people's mindset is that time is money, and the faster they get their destination is better. Instability of public transportation not only because of the lack of vehicle technologies, but also the bad behavior of passengers [1]. People in Indonesia still do not want to wait for queuing during ticket payment, and it leads to chaos in the queuing process.



This research wants to resolve the problem of using public transportation. This research focuses on how people can be satisfied with the services and system of public transportation if there is a system in public transportation payment that will ease people to use it.

2. Current Situation

Jakarta as the Capital City of Indonesia is surrounded by another city, like Bogor, Depok, Tangerang, and Bekasi (Jabodetabek). The number of urbanizations is increased in Jakarta. There are people from other provinces that move to Jakarta. There also many people have to work in Jakarta while they live in outskirts city of Jakarta [2]. The reason why people had to move to Jakarta is the higher wage. Moreover, it is true, the number of poverties in Jakarta is decreased from year to year [3].

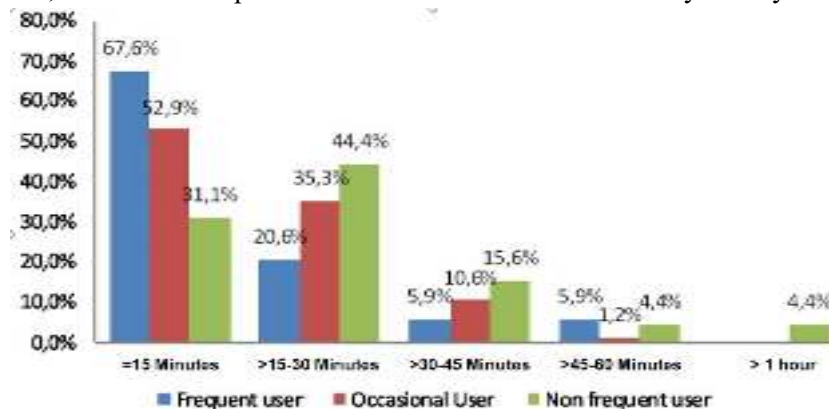


Figure 1. Statistic of TransJakarta usage. [Retrieved: from https://www.researchgate.net/publication/318593227_The_Perceived_Image_of_TransJakarta_Bus_Rapid_Transit]

The excellent income for people in Jakarta makes them buy their vehicles. The number of private cars is overgrowing from year to year. The motorcycle is dominating the population of a private vehicle in Jakarta [4]. There several public transportations used by people in Jakarta. Some of them are angkot, bus, transjakarta, and train. For public transportation, Transjakarta is often used by people. This is shown the number of TransJakarta usage. This indicates that 79% of all respondents in this research are not routine or regular users of TransJakarta service [5].

The online transportation services are overgrowing now. This system changes the behavior of people from conventional to a modern way. By using a smartphone, people can order transportation that ready to drive a user to a destination [6]. People choose to use this because of the flexibility and reliability to use the application. However, the existing of online transportation as public transportation is still a contradiction [7].

Current payment for Jakarta public transportation system nowadays mostly still uses cash and paper-based ticket but because of technology develop faster now there are lots of implementation in payment technology called e-payment, these are the current e-payment methods:

2.1. Electronic Wallet (E-Wallet)

In this digital era, the internet and gadget develop quickly where then many entrepreneurs and engineers see this opportunity to do developing products [8]. This day, many developers create an application of E-Wallet. The e-wallet payment system has the same function as the cash method, but the difference is the amount of money already converted into digital money stored in the user account and accessed online. There are several of E-Wallet that already can be used, Go-Pay and Ovo.

Transactions that usually took much time will now be completed in seconds using an electronic wallet [9]. An electronic wallet application is still developing in Indonesia. The most popular application is Near-Field Communication or can be called NFC. NFC system payment that uses

electronic wallet can be found in several places, such as in Transjakarta Busway that use Flazz as the payment and highway that also use BCA Flazz or Mandiri e-money.

The electronic wallet is handy for online shoppers because it fit our pocket and flexible to use. Also, it offers a secure and portable tool for online shopping. Electronic wallets store personal and financial information such as passwords, PINs, etc. [10]. Electronic payments digital currency has to meet several criteria, fulfill people's requirements [11].

2.2. Smart Card using NFC

The smart card is applying NFC technology. NFC is a short-range wireless technology that enables activity between electronic devices with a single tap [12]. NFC use as a tool to transfer data such as money balance. Smart can be used to store an amount of money as and do a transaction. Nowadays, there are lots of smart cards implemented in Indonesia, such as BCA Flazz, Mandiri e-money, Telkomsel T-cash, etc. This smart card used to pay a ticket for public transportation, like Transjakarta and KRL. Using NFC in the payment system can replace money or paper-based ticket, and also it saves time, less cash handle, and flexible in making a payment [13,14]. There are 3 of modes/function of NFC [15]:

- Card emulation use for storing all the data like Payment cards, identity car, and other information.
- Reader/writer uses to read or write the detected tags An example is smart cards.
- Peer-to-peer enables two NFC devices to exchange data with each other.

Nowadays payment for paying public transportation using NFC still using a smart card but now NFC for a mobile phone is on development to make it more efficient to use, examples of NFC mobile that is on development are like t-cash.

Furthermore, the E-Commerce business in Indonesia has multiplied that opened up many opportunities. For those who do not know about E-Commerce business. E-Commerce business is a business that uses technology where we could buy and sell items, primarily on the internet [16,17]. E-Commerce growth also runs parallel with the increase of e-wallet. E-Wallet nowadays has to implement QR-Pay to make the payment system more accessible, faster, and secure. QR-Pay uses photon checking encryption algorithm where we can encode and pack a picture containing essential data like ID, Photo, Content or URL and make it into different types of size like little, medium or large [18,19].



Figure 2. Type of QR-Code. [Retrieved from <https://blog.qrstuff.com/2011/01/18/what-size-should-a-qr->]

QR-Pay also makes the transaction faster and easier because customers and merchants do not need to meet to pay. Customers and merchants only need to chat through online chatting and customer pay by scanning a QR-code that is sent by the merchant [20], and through the ease of use and security of QR-Pay nowadays lots of e-commerce and e-wallet cooperated and make a cashback and redeem system. The implementation of cashback and redeem system will engage and give excellent service to the customer while the point could be redeemed with the gift from E-Commerce partner, so it will attract customers to come again and use application for the transaction [21,22].

Many strategies of marketing can be offered by E-Commerce; some of them are cashback and redeem point. These features are one of the factors many people nowadays choose to shop in E-

Commerce rather than in physical stores [23]. By using the cashback feature in E-Commerce, people's affection for the product is increasing [24]. Besides that, nowadays, lots of E-Commerce use social media by paying influencers or doing digital marketing to promote their E-Commerce, so lots of people can know about their E-Commerce. The growth of mobile fast which leads people to make payment more natural and faster rather than do a transaction using other devices. E-Commerce nowadays already implements AI (artificial intelligence) which the AI can track what we want to buy by monitoring our record on the internet [25,26]. To search the shortest path that users can use for public transportation, there is Dijkstra Algorithm. The Algorithm will be combined with Google Maps API; then it will search the nearest public transportation [27].

3. Solution

Based on the research, many challenges can be solved. We want to propose a system of e-payment that can be used by all users. This e-payment integrated with public transportation in Jakarta. This e-payment will have a partnership with several banks in Indonesia. However, we have limitations for the type of public transportation that can be ridden by the user. The public transportation should have its station, such as TransJakarta, train, and MRT. This is because we are using QR-Code to be scanned in a station. Use case in figure 3 shows the process where the passenger can register their account, do the login to the system, top-up balance, buy the tickets, shows the cashback and exchange the point with E-commerce system partners. Meanwhile, admin actor can view transaction data and manage the database in the system.

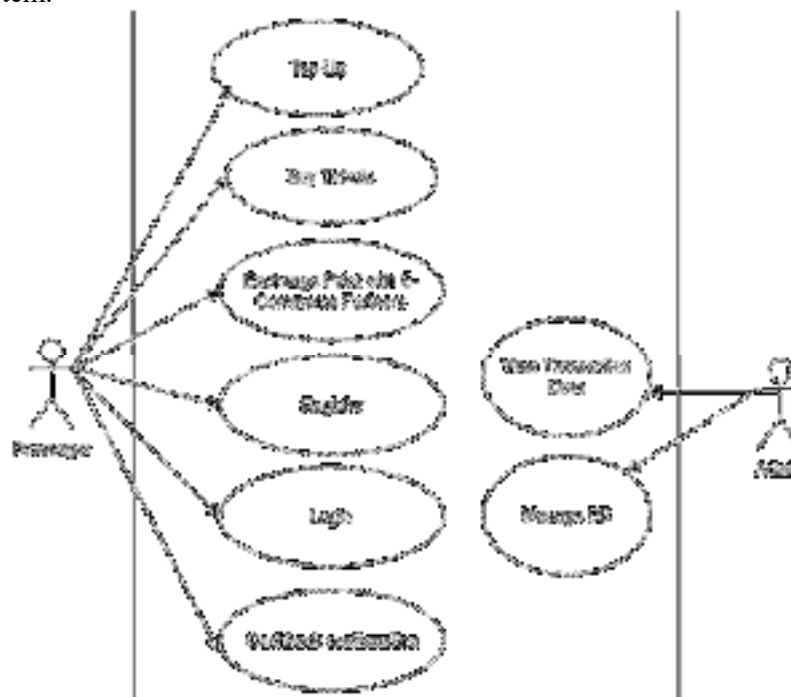


Figure 3. Uses case of the proposed system

E-payment is built in a mobile application and can be downloaded in a mobile store. In many cases, the QR Code generated by a machine that the user scans it, but in our system, the user's mobile phone will produce it. We believe if user QR-Code generated by phone is making the mobility of riding public transportation is faster than QR-Code generated by machine from the station. The engine is located in the station within the scanner for E-Money Card. Figure 3 shows the use case of our E-Wallet.

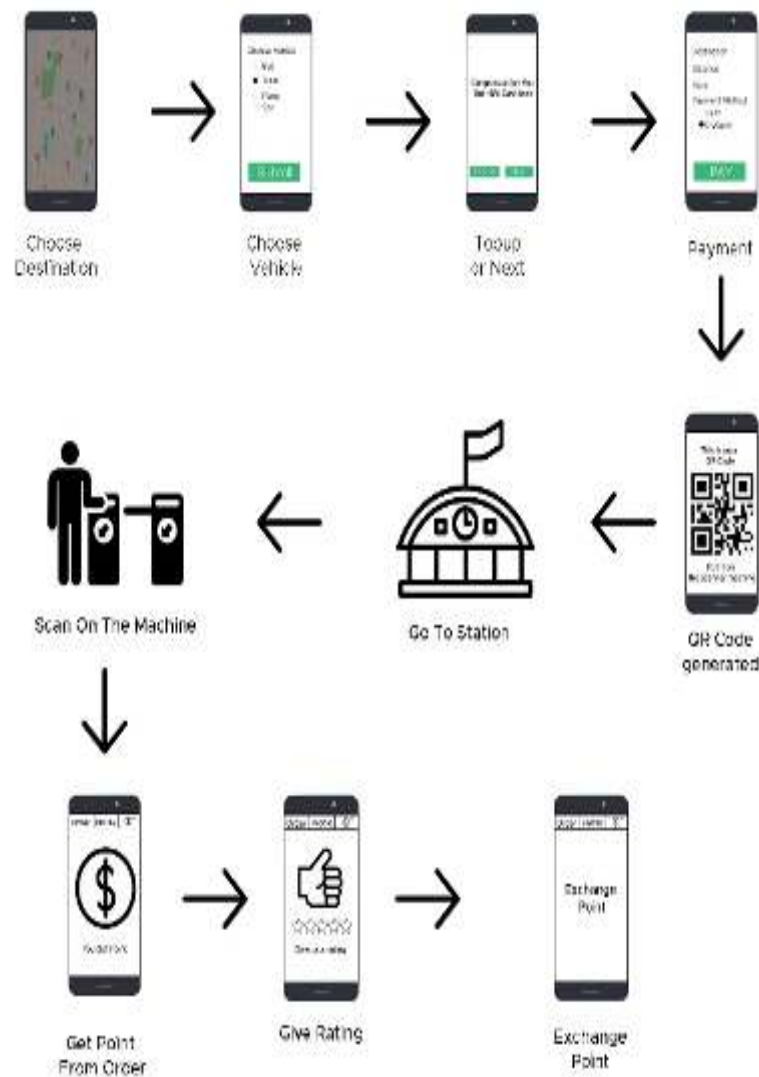


Figure 4. How the systems works

Every user has their account, so if they want to use e-payment, a user must register first. The e-payment will show a display of varieties of public transportation available at the current hour. After users choose the public transportation that they want to ride, the system will calculate prices to be paid. After that system will generate the QR-Code to be scanned on the machine when the user is riding public transportation. If QR is not being used, after two hours, QR-Code is expired, and the system will send back the balance of e-payment that has been paid.

The E-Wallet has a partnership with the government and another public transportation stakeholder. The user can get cash back when they are using the payment of this E-Wallet. The number of cashback is depended on the partnership or some events.

Not only that, the number of cashback is converted into a point. This point is another feature that can be used by a user to exchange the item. To get the point, the user must do a transaction using this application. Moreover, how to calculate it? Let say user get 20% cashback from TransJakarta and the price of riding TransJakarta is about IDR 3000. Then user got IDR 600 cashback from that journey. The number of cashback is also converted into a point, so user point gets addition 600 points.



Figure 5. (a) Homepage user interface, (b) Mobile phone scan the barcode, (c) Exchange the point to e-commerce

The point can be exchanged with an item from partners such as a voucher for buying food, tickets (airplane, train, or any other transportation), a voucher for a homestay, discount voucher when purchasing in web e-commerce. The benefit of this will not just affect the customer but also will give an excellent opportunity for an E-Commerce company. Even also, it will change the payment system in Indonesia for using the QR-Code payment. Not only that, but the user can also get the free point once a day by watching the partnership e-commerce ads.

This e-payment will also get a partnership with e-commerce transportation like GOJEK and Grab. These E-commerce transportations are the current best market startups. The user can get cash back by going from the user's current location to the nearest train station. This transaction can take only once a day and just for the train station destination.

Figure 6 shows the Entity-Relationship Diagram (ERD) the proposed system which contents 7 tables database such as table user which is used in registration process where to enter the user's data such as name, username, password, date of birth, gender, address, postcode and etc. Table transaction will be used to record the transaction when the passenger rides the public transportation by QR code scanning and will create the attribute transactionID and record the date and time of the current transaction. Table admin as recording our admin who handles and do some monitoring to each transaction. Moreover, the point based on each transaction will be recorded in table point and connect to table wallet which connects to bank account number which related to table bank which recorded all the banks.

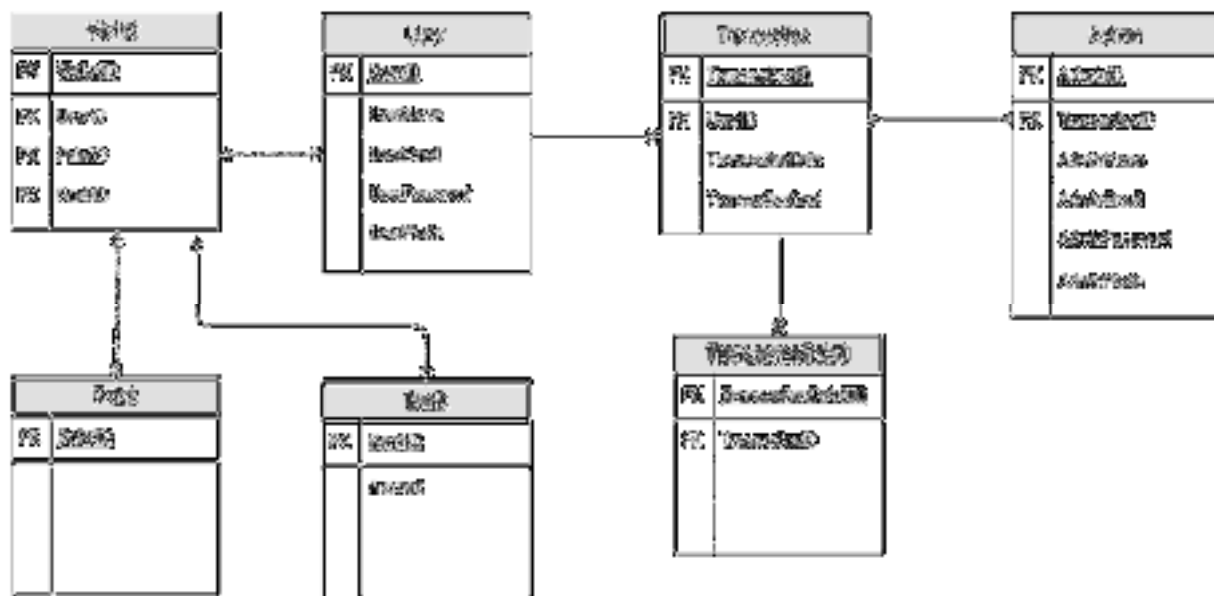


Figure 6. Entity relationship diagram of proposed system

4. Conclusion

Using payment by our E-Wallet will make the mobility of using public transportation much faster. The current situation, payment method requires a user to queuing to get the ticket. However, if the user uses it, you can order the ticket from the phone and get the QR-Code to be scanned. The E-Wallet has another feature that can attract people to use it, and they are cashback and redeem a prize or promo. In this paper, we still cannot make all of the public transportation integrated by our application.

In the future, this mobile application will be embedded with e-commerce system where all the e-commerce system can connect to this payment system and there is possible to get some income from e-commerce advertising in the mobile application. Moreover, implementation using the Internet of Things (IoT) will be accommodated in order to enhance the systems.

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