E-Payment System Using SMS Gateway and Line Application

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***Abstract*—The technology is used to achieve a wider marketing network, which can reach a wide range of consumer types, be it in terms of age and area. But the marketing and payment technology services made by e-commerce providers are only for urban communities with better internet access. Not for remote communities with limited internet connectivity. Therefore, an electronic payment system is required that not only target the urban community but also the rural community. The purpose of this research is to develop a payment system that can reach the entire area of Indonesia and most of Indonesia where most millenials use the line. sms is used in areas not covered by the internet by combining two technologies namely Line API and SMS Gateway. Line API is earmarked for marketing and payment of urban areas and SMS Gateway destined for rural communities. The end result of this research is the creation of electronic payment system or e-payment using SMS Gateway and Line API. Where this system can be used by the public to conduct any transaction whether it is payment, purchase of goods, top up balances, and balance transfers. Tests conducted on this system using black box method that focuses more on functional testing of the application or system to be built.**

Keywords— e-commerce, e-payment, line API, SMS Gateway

I. INTRODUCTION

Indonesia is the 4th most populous country in the world with a total population of nearly 246 million people in 2012. And the population will continue to grow from year to year. A large number of population, making Indonesia become one of the potential market shares. Especially the digital market, where everything is good that demand, supply, purchase, and sale using information technology and infrastructure that support it. Today, technology is widely used in the business world. The technology is used to achieve a wider marketing network, which can reach a wide range of consumer types, be it in terms of age and area. At this time of globalization, each person must have a gadget or smartphone. Mobile equipment as above is no longer a luxury item that can only be reached by upper middle class. But now can be reached by the middle to lower society. This makes the digital market becomes more attractive for business actors. Various kinds of e-commerce providers begin to provide services for each business actor who wants their products on offer through the internet and website. For example tokopedia, bukalapak, belibeli, lazada and bhinneka and much more e-commerce providers. But the marketing technology services undertaken by the above e-commerce providers are only for urban communities with better internet access. Not for remote communities with limited internet connectivity. To purchase goods from an e-commerce provider the community must first go to the nearest city to be able to access the desired goods. This causes the wheels of economic growth to be slow and only focused on urban areas only. But unlike the case with SMS methods, SMS methods such as SMS banking requires only regular network, does not require internet connectivity. Using the technology, remote communities can enjoy faster purchasing and selling processes, and without having to use cash. By implementing an e-payment system, business actors and consumers can transact without having to use cash or without using real money. In addition to SMS technology, we can also use social media such as line and Facebook to increase regional economic growth. Indonesia is an Asian country most users of social media. This, of course, encourages marketing is more advanced than ever before. Because of the above problems the author intends to create an e-payment system that not only uses the internet and social media but also uses SMS technology. The purpose of this research is to develop a payment system that can reach the entire area of Indonesia and most of Indonesia where most milenials use the line. SMS is used in areas not covered by the internet.

II. LITERATURE REVIEW

A. Short Message Service (SMS)

Short message service (SMS) has been growing rapidly since it was used initially by Neil Papworth on December 3, 1992. Nowadays, short message service (SMS) has become a very fervent communication tool for transferring the world-wide information by using Global System for Mobile Communication (GSM) network [1]. SMS is also defined as a basic protocol for sending and receiving messages in text form mobile phone [2]. SMS is composed of serving factors connected with submitting or receiving, just like period of validity and priority. Otherwise, SMS also provides the time of submitting message, informing whether the mobile plat

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needs more massage to be sent and how many messages need to be sent [9].

B. SMS Gateway

SMS Gateway is a middleware service that enables sending and receiving SMS from an application point of view, it is ideal to let software services automatically communicate with end users via SMS channels, regardless of GSM telecommunication provider providing SMS service [3].

C. E-Business

E-Business is a broader definition of e-commerce and not only seen from the side of the sale and purchase of products/services but also serve consumers, collaborate with other business partners and manage electronic transactions within an organization [4].

D. E-Payment

E-Payment (electronic payment) or often referred to as electronic payment, electronic means using electronic means as a means of payment, payments that occur not with cash or using the actual physical money, but through other physical media that can contain nominal money [4].

E. E-Commerce

E-Commerce is all through the intermediary electronically and into the exchange of information between the company and organization with its shareholders from outside parties [4]. Electronic Commerce is a concept that describes a process of buying and selling or exchange of goods, services, and information through computer networks, including the internet [5].

F. API

The Application Programming Interface (API) is a set of visible code elements provided by a framework or library, and such libraries or frameworks are called API libraries. API libraries are also referred to as API codes [6]. Client Code is an application code that reuses or expands the code elements provided by the API library [6]. API Usage is a way to call the API code, which includes the sequence of calls or invariants [6]. So it can be said that the Library API is called by the code or script provided by the user, in this case, the author of the application by using the methods or procedures that exist in the API Usage. the REST API is based on REST architectural style, which is using text-based JSON message over HTTP transport [10]. Application Programming Interface (API) is defined as interfaces used by software component to communicate with each other [8].

G. Line Messaging API

Messaging API allows data to be sent to your bot's app server and the LINE Platform. When a user sends a bot you have with a message, a webhook will be triggered and the LINE Platform sends a request to your webhook URL. Your server then sends a request to the LINE Platform to respond to user requests. Request sent via HTTPS in JSON format [7].

III. PROPOSED METHOD

Based on several references, this study is designed for E-Payment System Using SMS Gateway And Line Application with the architecture can be seen in Fig. 1.

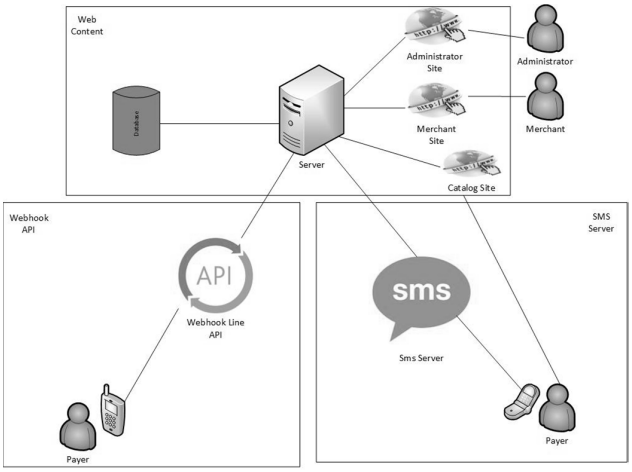

Figure 1. Architecture of e-payment system using SMS gateway and line application.

This system works by integrating Web content, Webhook API as well as SMS server. The ultimate goal of this system is to serve requests for information and transactions from users, in this case, are payers, merchants, and administrators. Information displayed using two main display of Webhook API and web content. The Webhook API displays information about the transaction process otherwise the web content displays information about the components required to carry out the transaction process. Illustration of information display of this system is illustrated by the use case diagram in Fig. 2.

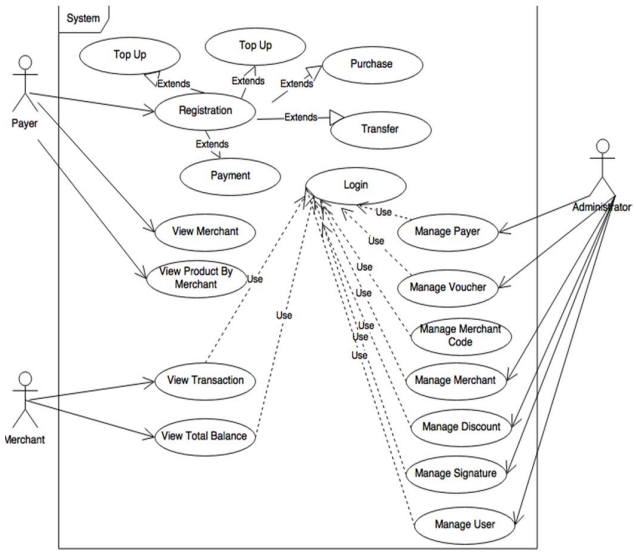

Figure 2. Use case display e-payment application information.

The process of system integration begins when a consumer registers as a payer of this e-payment system. Consumer

registration can be done using three ways: registration through the administrator, registration via SMS and registration through line application. Registration via administrator starts when the consumer comes directly to the admin of this e-payment system and asks to be registered as a payer in the system. Registration via SMS begins when the consumer sends a command to the e-payment system using SMS where the contents of the command are REG Pin Name KodeVoucher.

The registration through the Line starts when the consumer or user sends the REG Name Pin NoHp KodeVoucher through e-payment line account. Prior to the registration process, the consumer or user cannot perform transactions in this e-payment system. After successful registration process consumers can make transactions using two ways: use the application line and use SMS gateway. Each way has its own command format. The next process is merchant registration. Merchant registration can only be done through an administrator. The registration process begins when the store comes to the admin requesting to be registered into the system as a merchant. Then the admin process the input to data merchant, the product offered by the merchant and the account that will be used as the identity of the store at the time of the transaction. In addition to the above three data, the admin also inputs the user data. It is intended that the merchant or store can access the transaction and balance data obtained from the transaction using merchant e-payment website.

The next process is the input of other e-payment components, including discount data and voucher data. This process can only be performed by an administrator. Voucher data will be used for the registration process either using SMS gateways or line application and top up process. Discount data will be used when making a payment at a store or merchant, so payers get a discount based on the amount of discount available on the discount code. The next process is the transaction process, transactions on the e-payment system are divided into 4 types of transfer, purchase, payment and top up.

The transaction process can only be done by the payer listed on the system. The transfer process aims to make balance transfers between payers. Purchase process aims to make purchases of products or goods listed in the system, after making the process of purchasing a balance of payers who make purchases will be reduced based on total purchases made. The payment process aims to make direct payments to the store or merchant after making a direct purchase without using the system, as well as on purchases, the payer balance payment process will also be reduced by total purchases.

Top up process is a process to make additional balance owned by payer, this top up process can be done using two ways that is through voucher code and through payment gateway dokupay. for voucher code, payer only have to make a purchase voucher, by using the code contained in the voucher, the payer can do top up using sms gateway and line in accordance with the transaction format on each part. The second way is to use dokupay. In this process the payer only has to transfer to a predetermined account, by entering the reference code of the payer account number, the amount of the payer balance will increase according to the amount sent through the account.

For more detail, we can see the flow of logic that will be described by flowmap in Fig. 3 and Fig. 4 below.

A. Transaction Using SMS Gateway

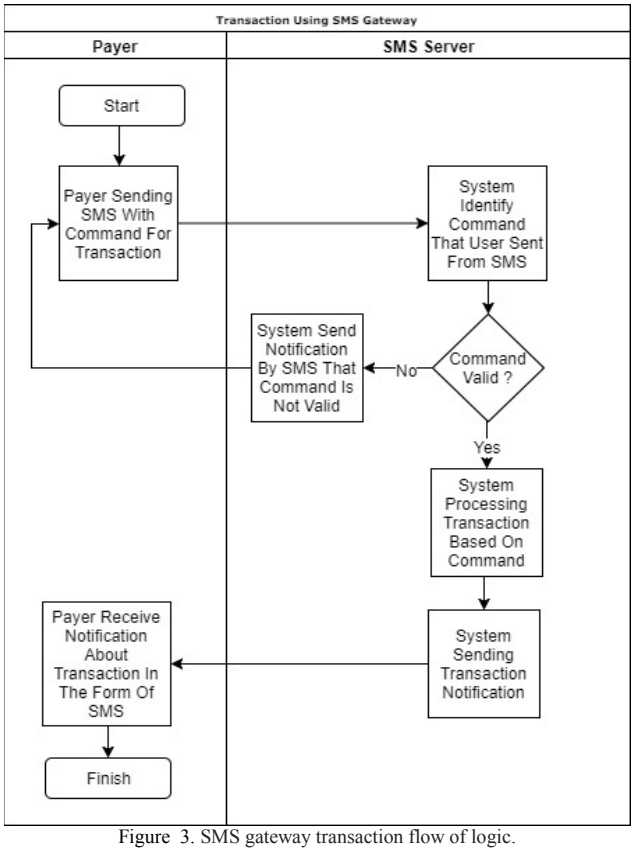

Figure 3. SMS gateway transaction flow of logic.

The system is divided into five processes or stages of sending SMS, the identification of commands sent by the user or payer, processing transactions based on commands sent, sending notification of transactions to the user, as well as receipt of notification in the form of SMS to the user. The system as a whole has several functions:

1) A system capable to receive SMS sent by the user using a mobile phone.
2) The system is able to identify the received SMS and classify the commands that are sent.
3) The system can perform transaction processing based on the command sent by the user.
4) The system can send SMS notification about the status of transactions desired by the user either failed or successful.

B. Transaction Using Line

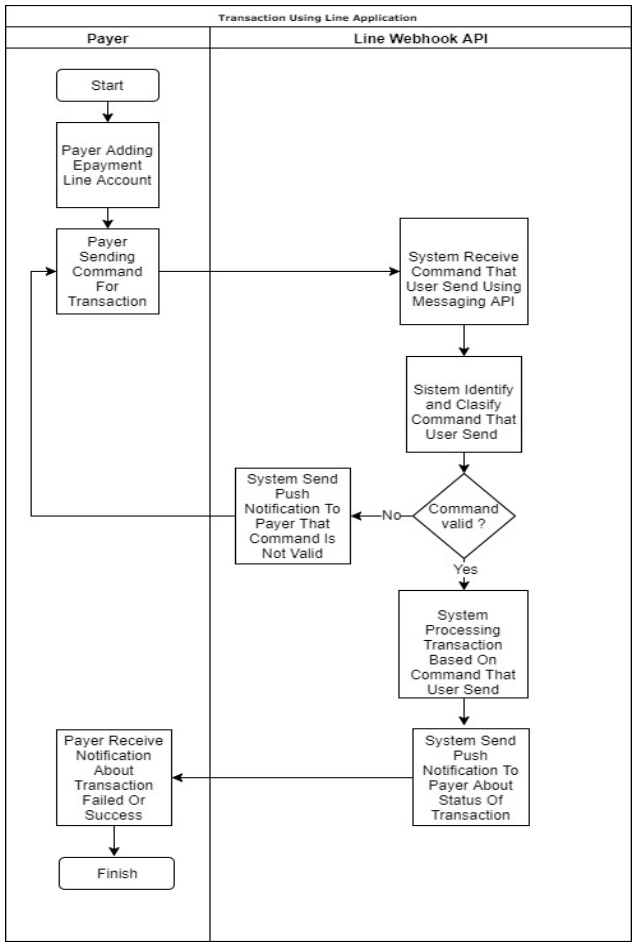

Figure 4. Line transaction flow of logic.

The system is divided into seven processes or stages of adding the account line e-payment, the delivery of orders by the user or payer, the acceptance of commands sent by the user system, the identification of commands sent by the user or payer, processing transactions based on orders sent, sending notification transactions to the user transaction status, and acceptance of notification in Line user account. The system as a whole has several functions:

1) The system is able to receive commands sent by the user using social media line.
2) The system is able to identify the received commands and classify the commands that are sent.
3) The system can perform transaction processing based on the command sent by the user.
4) The system can send a notification to the user's account about the transaction status desired by the user either failed or successful.

Here is a sequence diagram of e-payment system using SMS gateway and line API, as seen in Fig. 5 and Fig. 6 below.

C. Sequence Diagram Transaction Using SMS Gateway

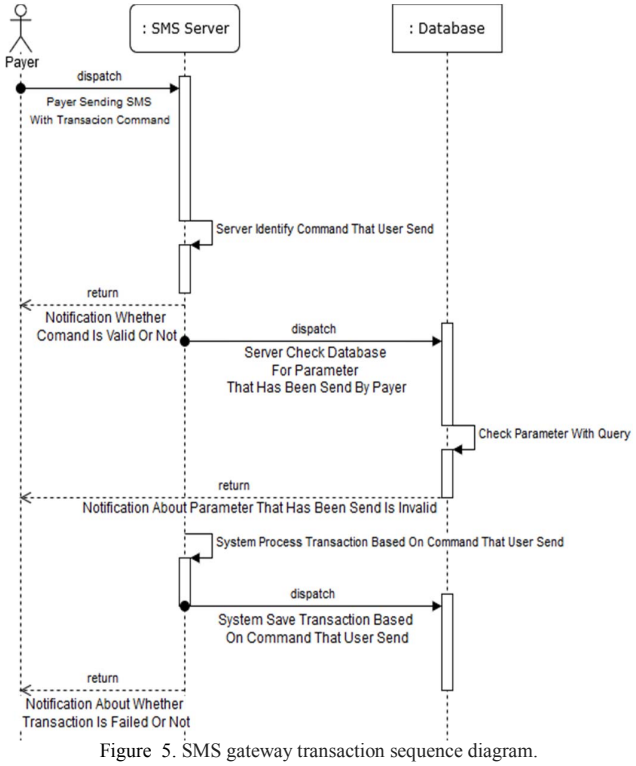

Figure 5. SMS gateway transaction sequence diagram.

D. Sequence Diagram Transaction Using Line Application

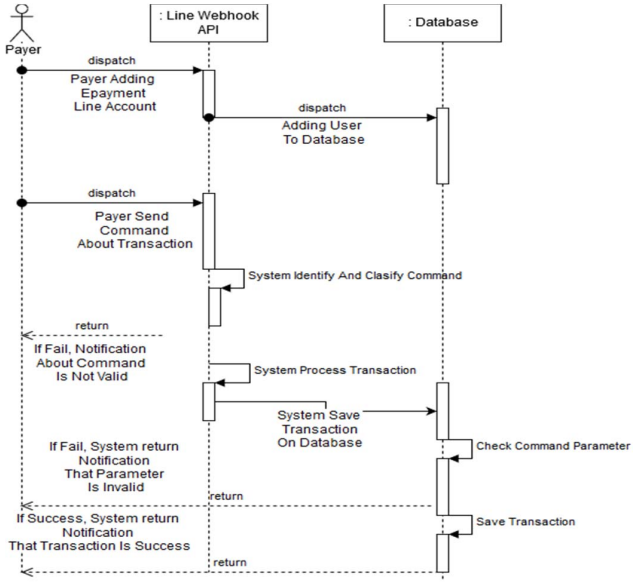

Figure 6. Line transaction sequence diagram.

Command that can be used to do transaction is specified by Table I below.

TABLE I. TRANSACTION COMMAND FOR E-PAYMENT

Application	User Command	Description
Line	MENU	Displays the E-payment Application MENU on the line application
	1	Displays the description of the application as well as the form of transactions that can be done on Line e-payment application
	2	Displays info as well as registration procedures into the e-payment system
	3	Displays the transaction format to be used by the user
	4	Displays a list of stores or merchants listed on the e-payment system
	BUY AccNum ProductId Amount PIN	purchase goods owned by merchants through e-payment line account
	TRF AccNumberSend AccNumer Dest Amount PIN	Perform balance transfers between accounts registered in the e-payment system
	BAYAR Amount AccNum MerchantCode PIN	Make a direct payment to a store or merchant using an e-payment line account
	REG Name PIN NoHp VoucherCode	Register into the e-payment system as a payer
	SAL PIN AccNum	Displays the balance held by the payer account listed on the e-payment system
	TOP PIN AccNum VoucherCode	Make a balance or top up balance based on the number of top-up performed
SMS Gateway	TRF Account Dest Amount PIN	Perform balance transfers between accounts registered in the e-payment system
	BAYAR Amount MerchantCode PIN	Make a direct payment to the store or merchant using SMS gateway
	REG name pin Voucher Code	Register into the e-payment system as a payer
	SAL PIN	Displays the balance held by the payer account listed on the e-payment system
	TOP VoucherCode PIN	Make a balance or top up balance based on the number of top-up performed
	BUY productId Amount PIN	purchase goods owned by merchants through SMS Gateway

IV. SECURITY OVERVIEW

For security issues, the e-payment system is divided into two parts: Line API and SMS Gateway. In the Line API the security configuration is set using line developer, line API uses channel access token and channel secret as security parameter, when developer wants to use line API, developer must provide channel access token and channel secret embedded in Library line API to be able to communicate with account line owned. In addition, when transactions using the line, the system first check the PIN entered by the user, if the PIN does not match then the transaction will not be processed.In SMS Gateway, security is more emphasized on transaction security. Therefore, in the SMS gateway there are two verifications, the first is the verification of the mobile phone number and the second is the verification of the PIN, verification of the mobile phone number is done to ensure that the user using the system has been registered, while the PIN verification is done to validate the transactions performed by the user, is performed by the user or not.

V. IMPLEMENTATION AND RESULT

To implement this application, it requires hardware and software support, which are very useful for data processing. Hardware and software requirement are listed below

A. Implementation

For modem spesification are GPRS class 10 capabilities using AT and AT protocols such as IP connectivity with standardized features, Dual-Band EGSM 900/1800 MHz.For server requirement, minimum of Intel Core i3 or similar, at least 8 GB for the server memory, hard drive for storage media, at least 5 GB, exclude operating system and other application. For SMS server minimum requirement are Intel Core i3 or similar, at least 4 GB of the server memory. For client requirement, minimum of Intel Pentium 4 or similar, at least 1 GB server memory. For mobile device client, the minimum requirement is android 4.1 jelly bean as the operating system. At least 1 GB of Memory, and 16 GB storage media. This software is needed to run the application. There are sublime text 3 as a programming editor, MySQL as a database server, Apace 2 as a web server for web content, SMS Server, and Webhook API, Gammu as SMS daemon, and line for webhook API interface. Scenario For implementation is listed below. For top up scenario. Top up is done using payment gateway Dokupay, payer only send a certain amount on the account number that has been provided. After performing the process of top up. Dokupay will provide notification to the system to make additional balance in accordance with the amount of money sent by the payer.

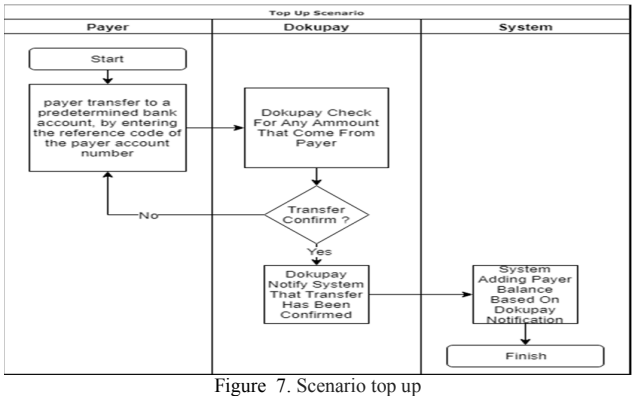

Figure 7. Scenario top up

Scenario implementation for merchants is done in coffee shops, gift shop, restaurants, street vendors as well as souvenir shops on the sidewalk, payers can make purchases and payments at the shops mentioned above. From these payments the store will receive an income based on the amount of purchase and payment made by the payer. Detail implementation on merchant is ilustrated by flowmap in Fig. 8 below.

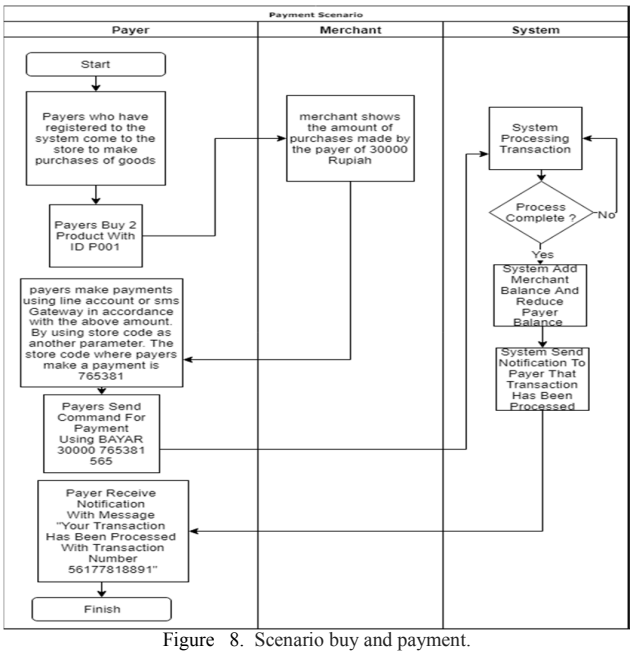

Figure 8. Scenario buy and payment.

B. Result

We do the test by comparing the delay response time of each transaction that is done through SMS gateway and line application, the delay calculation is the time required by the payer when sending the command up to the response provided by the system. Table II gives the test results of average response time delay for each kind of transaction.

TABLE II. RESPONSE TIME DELAY

No	Average of Response Time Delay (in Second)		
	Transaction	*SMS*	*Line*
1	Purchase	36.3	1,6
2	Balance Check	30	1.3
3	Payment	36.7	1.2
4	Registration	37	1.8
5	Transfer	34.4	1.2
6	Top Up	32.8	1.7

VI. CONCLUSION

In this paper, we have presented e-payment system using SMS gateway and line application. With this system, people transaction is not just bound by the availability of the internet, but with just gsm signal people can buy and pay for anything they want without worrying about is there any internet signal or not. The response time test showed that line application has faster response time than SMS.

REFERENCES

[1] C. Taddia and G. Mazzini, "Architectures for an Efficient SMS Gateway Service", Proceedings of 23rd International Conference on Software , Telecommunications and Computer Networks (SoftCom), 2015

[2] S. Firdaus, "The Development of the Short Messaging Service (SMS) Application for the School Usage," pp. 1382–1386, 2010. I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[3] Chaniago Muhammad Benny, Junaidi Apri, "SMS Gateway and Barcode Technology for Presence of Students in SMK Unggulan Terpadu PGII Bandung: a Case Study", Proceedings of 4th International Conference on Cyber and IT Service Management, 2016.

[4] Turban, E. 2002. "Electronic Commerce: A Managerial Perspective" 2002, New Jersey: Prentice Hall.

[5] Chaffey, Dave. 2002. E-Business and E-Commerce Management, Strategy, Implementation, and Practice 4th Edition, Prentice Hall.

[6] Hao Zhong, Hong Mei, "An Empirical Study on API Usages", IEEE Transactions on Software Engineering, 2017, pp. 1-1.

[7] Line.me, "Line Messaging API How It Works",2018, Available: https://developers.line.me/en/docs/messaging-api/overview/. [Accessed 22 – January – 2018]

[8] Gleison Brito, Andre Hora , Marco Tulia Valente, Romain Robbes ,On the use of replacement messages in API deprecation: An empirical study,The Journal Of System and Software, 2018.

[9] Yan Li, Meifang Chen, Jie Nie, Mobile Commerce Security Model Construction Based on SMS, Proceedings of 7th International Conference On Wireless Communication, Networking and Mobile Computing, 2011.

[10] Longji Tang, Liubo Ouyang, Wei-Tek Tsai, Multi-factor Web API Security For Securing Mobile Cloud, Proceedings of 12th International Conference on Fuzzy Systems and Knowledge Discovery, 2015.