Smart Vending Machine Based on SMS Gateway For General Transactions

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***Abstract*— this paper presents design and experimental studies of vending machine for office stationery Transactions. The advantage of the proposed vending machine i.e. Transaction can be done by using short message system (SMS), all transaction can be monitored online by owner by using Android, the vending machine has feature early warning system (EWS) when system in trouble, and it also equipped with battery backup when electricity cut off, No need to make special agreement with bank or telecommunication provider. The Smart Vending Machine is built by using common hardware component such as Arduino as controller, Wavecome as SMS Gateway module, Servos, Power Supply, Battery as power back up, Keypad and button as input, LCD 16x2 as Display. From the several test including normal transaction, online monitoring, and early warning system for electricity supply. The Smart Vending Machine was successful. And it has a big possibility to be mass production.**

Keywords -Smart Vending Machine; TCASH; Digital payment service;Telkomsel; TCASH Balance.and alequiped

I. INTRODUCTION

In this modern era many researchers have developed software and hardware to realize innovation product. Either based on numerical analysis [1-3] and artificial intelligent[4-14]. The innovation product is aimed to meet the needs of the modern community faster and easier. For example who work in university, government office, school, and related area of work. They need a variety of stationery which are available for 24 hour to complete the job with a quick deadline. The kind of innovation product to solve the problem is Vending machine. The advantages of vending machine are it easy to use, safe in transaction, and it can be used for 24 hours. Even though vending machine is very popular retail transaction in Indonesia [15]. But, there are some aspects are need to be improved, such as the technology used in the vending machines that available in Indonesia are still use cash money as a transaction method. [16]. These methods have many disadvantages for example they reject money with bad quality of paper, they cannot detect counterfeit money, the price of goods is depend on the denominations in circular of money so the price become little bit expensive. In other hand, some vending machines are equipped with card as transactions method [17]. The use of the card can solve some disadvantages of traditional vending machines, such as avoiding using at counterfeit money, and the price of goods not depend on the denomination of circulating money. But the distribution of the card is limited, only in the capital city, so it have difficulties when it applied in district area. To solve those problems, in this paper is proposed the new vending machine based on SMS (Short Message System) gateway system. Generally, the smart vending machine can be operated for all telecommunication provider that has feature of transfer balance. In this paper will explained performance of smart vending machine with TCASH (Telkomsel Cash) as feature for SMS gateway system. TCASH is one of product in Telkomsel. Telkomsel is the biggest Indonesian provider of telecommunication that has been covered all district in Indonesia. The utilization of TCASH in vending machine that have many advantages such as the transaction is safe, it use TCASH balance for transaction so it can be solve the problems of rejecting money that bad quality, and avoiding using at counterfeit money, the price of goods can be set, and it can be used in district area in Indonesia. By booking through the SSID number of Telkomsel, customers can order the product for free to their mobile phones, and can take their products after verifying in vending machines with their telephone number using the keypad for security [18].

II. METHODOLOGY

In this chapter, it will be discussed about SMS Gateway, and explain each stage of research. The SMS Gateway module can be defined as a module that can call, send or receive messages without using a mobile phone. In this research SMS Gateway is used to receive messages from provider, SMS contains confirmation of payment from customer. There are two methods in this study that are divided into customer ordering method, and processing method with vending machine, there are two stages in ordering method: Order process, and confirmation process as in Fig. 1, there are four stages in processing method: Initialization of component, Verification process, Product selection, and Confirmation process to continue or complete transaction as shown in Fig. 2. in this research also equipped with online monitoring system in Fig. 3, and early warning system in Fig. 4.

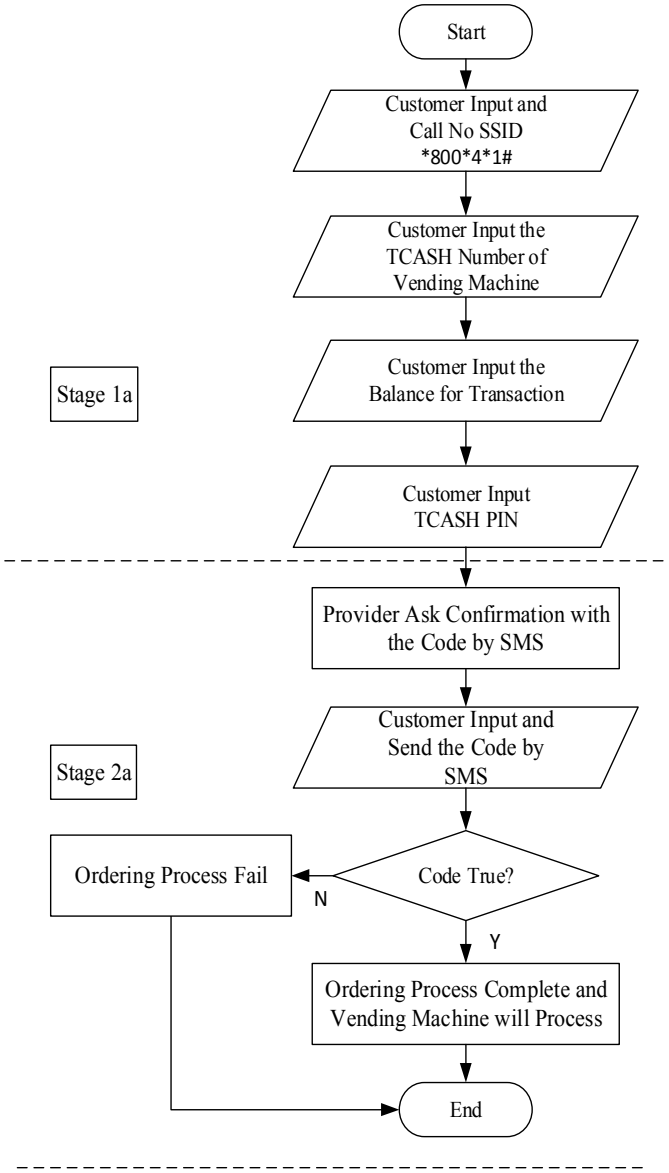

Fig. 1. Flowchart of Ordering Method

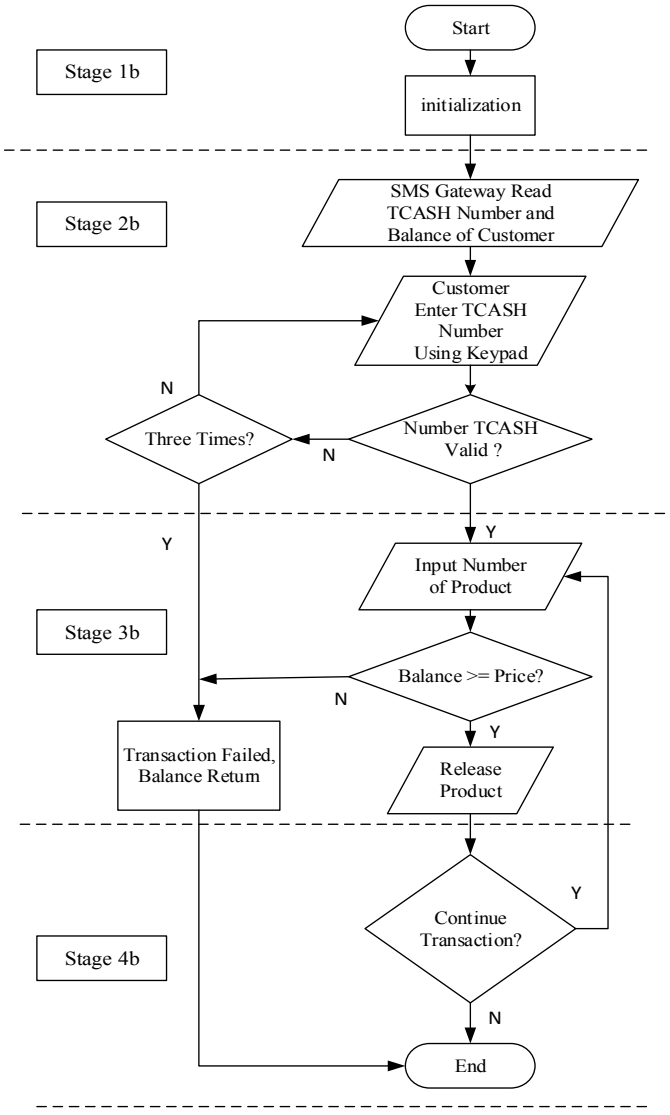

Fig. 2. Flowchart of Processing

Stage 1a: Flowchart started by calling SSID number, that is *800*4*1# to start TCASH service from Telkomsel. Then Customer input the TCASH number of Vending machine, the TCASH number in this research is 085230572217. Customer input the TCASH balance for example 9000 to send Rp.9.000, and then Customer input 6 digits PIN number for security.

Stage 2a: After customer input the PIN, customer will receive SMS from providers which ask the confirmation code from customer, customer send the code by SMS, if the code is true, then ordering process complete and Vending machine will process the transaction, but if the code is wrong, then transaction failed.

Stage 1b: Flowchart started the initialization of the components used in the vending machine, "SMS gateway" to receive data SMS from provider, Arduino to process data[9] SMS from “SMS gateway”, keypad to enter a verification number and choose the product, servo motor to release products and LCD as display [19].

Stage 2b: Ordering products can be identified with SMS notification by the provider, when customers order products and "SMS gateway" receives SMS notifications contain TCASH number and balance of customer from the provider, then the Arduino will process the data SMS and ask the customer to enter the TCASH number for verification process. Customer enters TCASH number, if customer is wrong to enter the TCASH number for 3 times, then the transaction fails and balances that have been submitted will be returned.

Stage 3b: If customer is true to enter the TCASH number, the customer must press the keypad according to the number of products to choose products. If the balance is less than the price of the product then the transaction will be canceled and the money refunded by the user to the customer, if greater than or equal to the price of the product, the product will be released.

Stage 4b: The transaction not only can be done once, but transactions can be carried out several times in accordance with the balance of the customer. So that each delivery balances, customers can make purchases several different products. The transaction will be completed when the customer presses the "Cancel" or the balance is not sufficient to complete the transaction.

Online monitoring system in this research uses Wemos d1 wifi module. Transaction data on vending machine is sent to online data base using internet network. So the owner can monitor all transaction data every day using smart phone android. Scheme of the online monitoring system such as Fig. 3.

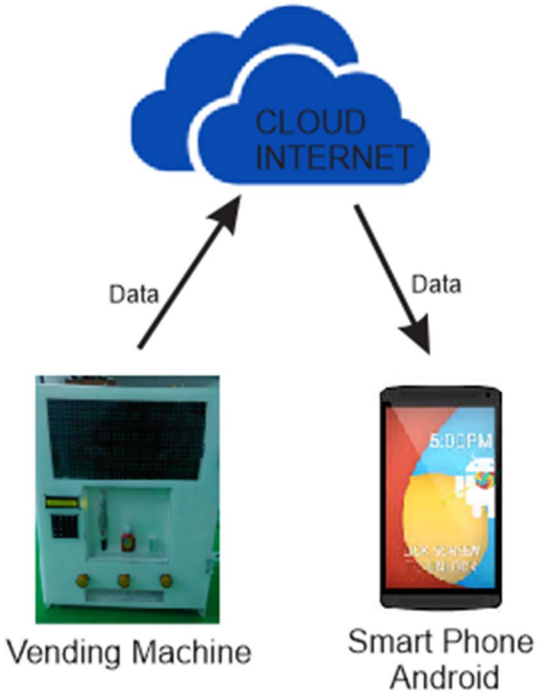

Fig. 3. Scheme of the online monitoring

The early warning system in this study is one of the security of the vending machine, the early warning system will work when the power source from main supply of electricity goes off. If the main supply of electricity source on the vending machine is off then the battery will back up the power source of the vending machine, and the system will give warning to the owner using SMS (short message system). The flowchart of the early warning system is shown in picture 4.

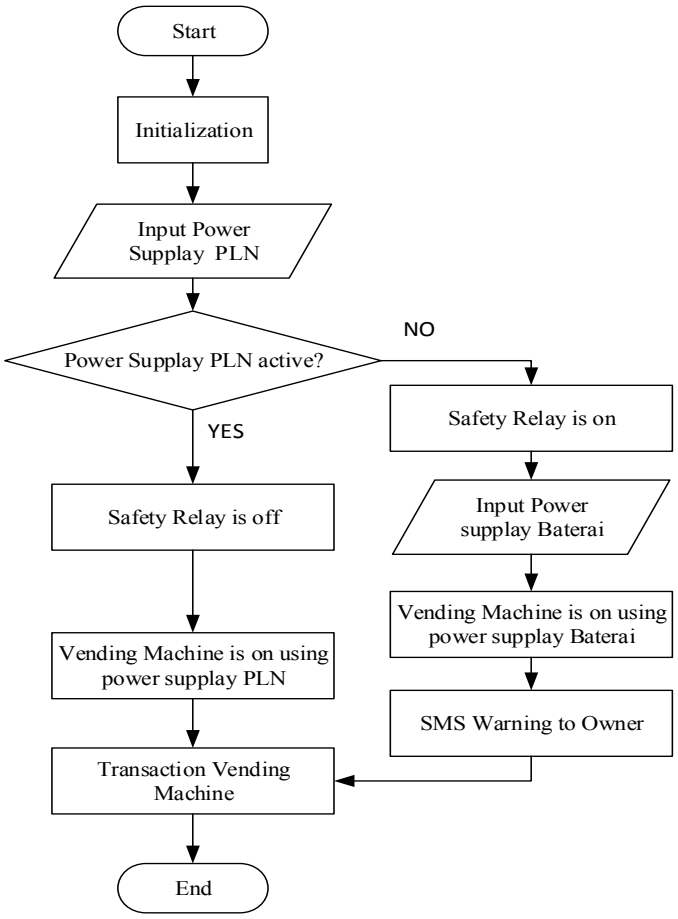

Fig. 4. Flowchart Early Warning System

The flowchart starts with the initialization of the component. When the vending machine is working normally, the vending machine uses a power source from PLN (main supply of electricity), if the PLN power source is off, the safety relay will be activated, the power source will change to the battery, and the early warning system will send an SMS to the Owner that the PLN power source off and vending machine will be off if the battery power is empty.

III. DATA ANALYSIS

To verify performance of smart vending machine as shown in Fig. 5, there are three cases conducted in this paper. The first case is normal operation. The second case is online monitoring system and the third case is early warning systems. The three cases mentioned earlier are available for any kind of provider that have balance transfer feature using SMS (short message system). Because of the limitation space, in this paper only discuss about transfer balance feature using TCASH (Telkomsel Cash) as information that Telkomsel is the biggest Indonesian cellular provider. There are three kind of testing scenario ie : testing for single item purchasing, testing for double purchasing, and testing for triple item purchasing. The first item is Rp.4.000, the price of the second item is Rp.3.000, and the price of the third item is Rp.2.000.

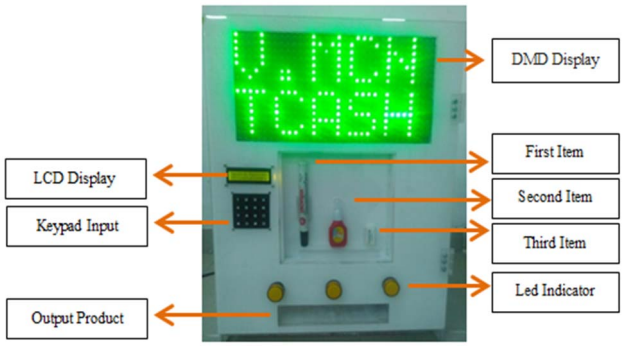

Fig. 5. Hardware of Vending Machine.

For example, the customer sends a TCASH balance is Rp.4.000 and select the first item, or send the Rp.2.000 and select the third item, or send 4.000 and selecting the third item, and then end the transaction (Rp.1.750 will refund to customer). If the balance is less than the cheapest price or customer press "C" button to stop the transaction, vending machine will return the remaining balance of the transaction minus the cost of SMS (Rp.250). In this research, the transaction with one item performed 10 times trial, each experiment done by selecting with different item and different TCASH balance as in table 1.

TABLE I. EXPERIMENT WITH THE PURCHASE OF ONE ITEM.

No	Balance (Rp)	Transaction and Price (Rp)			Refund (Rp)	Status
		1	*2*	*3*		
1	2,000	2,000	-	-	-	Success
2	3,000	3,000	-	-	-	Success
3	4,000	4,000	-	-	-	Success
4	4,000	4,000	-	-	-	Success
5	3,000	3,000	-	-	-	Success
6	5,500	4,000	-	-	1250	Success
7	4,500	3,000	-	-	1250	Success
8	3,500	2,000	-	-	1250	Success
9	6,000	4,000	-	-	1,750	Success
10	6,500	4,000	-	-	2,250	Success

In the second scenario, the customer sends a TCASH balance is Rp.6.000 and select the first item and third item, or send the Rp.5.000 and select the second item and third item, or send 9.000 and selecting the first item and second item, and then end the transaction (Rp.1.750 have to refund to customer). If the balance is less than the cheapest price or customer press "C" button to stop the transaction, vending machine will return the remaining balance of the transaction minus the cost of SMS (Rp.250). In this research, the transaction with two item performed 10 times trial, each experiment done by selecting with different item and different TCASH balance as in table 2.

TABLE II. EXPERIMENT WITH THE PURCHASE OF TWO ITEMS.

No	Balance (Rp)	Transaction and Price (Rp)			Refund (Rp)	Status
		1	*2*	*3*		
1	5,000	3,000	2,000	-	-	Success
2	5,000	2,000	3,000	-	-	Success
3	7,000	4,000	3,000	-	-	Success
4	7,000	3,000	4,000	-	-	Success
5	6,000	4,000	2,000	-	-	Success
6	6,000	2,000	4,000	-	-	Success
7	7,000	2,000	3,000	-	1750	Success
8	7,500	3,000	3,000	-	1250	Success
9	10,000	3,000	4,000	-	2,750	Success
10	11,500	4,000	4,000	-	3,250	Success

While in the third scenario, the customer sends a TCASH balance is Rp.9.000 and select the first item, second item and third item, or send 8.000 and selecting the first item and third item in two times, or send 10.000 and selecting the third item and second item in two times, and then end the transaction (Rp.1.750 have to refund to customer). If the balance is less than the price or customer press "C" button to stop the transaction, vending machine will return the remaining balance of the transaction minus the cost of SMS (Rp.250). In this research, the transaction with three items performed 10 times trial, each experiment done by selecting with different item and different TCASH balance as in table 3.

TABLE III. EXPERIMENT WITH THE PURCHASE OF THREE ITEMS.

No	Balance (Rp)	Transaction and Price (Rp)			Refund (Rp)	Status
		1	*2*	*3*		
1	9,000	3,000	2,000	4,000	-	Success
2	9,000	2,000	3,000	4,000	-	Success
3	8,000	2,000	3,000	3,000	-	Success
4	9,000	4,000	3,000	2,000	-	Success
5	10,000	4,000	4,000	2,000	-	Success
6	7,000	3,000	2,000	2,000	-	Success
7	14,000	4,000	4,000	3,000	2,750	Success
8	11,500	4,000	2,000	3,000	2,250	Success
9	13,500	4,000	4,000	4,000	1,250	Success
10	12,500	3,000	3,000	2,000	4,250	Success

Owner can monitor transactions in Vending machine using smartphone android anywhere with internet network for 24 hours. The owner can view the data on the number of transactions on the vending machine as shown in Fig. 6, the number of each product sold as Fig. 7, and the condition of the power supply as shown in Fig. 8.

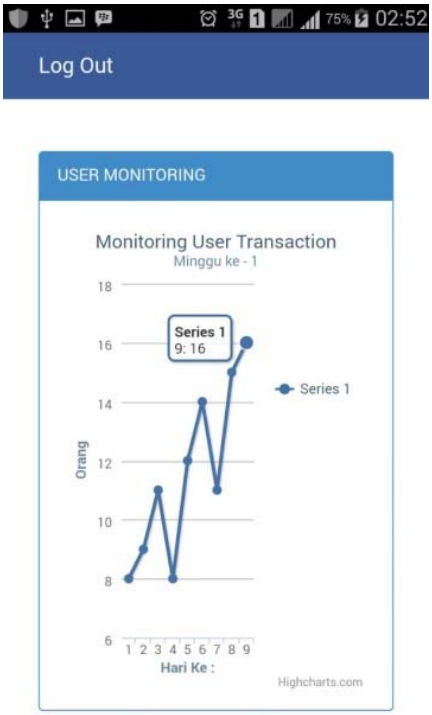

Fig. 6. Android screen of number transactions

Fig. 6 is the android screen for monitoring the number transactions performed every day, the x-axis is the day data, and the y-axis is the number of users vending machine. In this study conduct experiments for nine days in the MRC-PPNS.

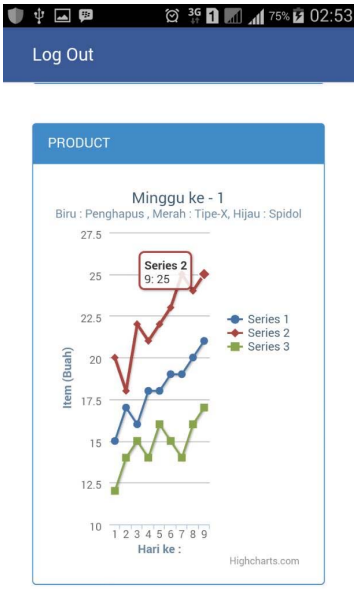

Fig. 7. Android screen of number product sold

Fig. 7 is the android screen for monitoring the number of products sold every day, x axis is the day data, and the y axis is the number of products sold. In this study conducted experiments using 3 types of product. There are Erasers (Blue), Type-x (Red), Markers (Green).

Fig. 8. Android screen of table of power supply

Fig. 8 is a table on the android screen to monitor the condition of power supply in the vending machine, there are 3 columns in this table, there are column of number, date and time columns, and the condition column of the power supply. If PLN power on vending machine is “on”, then column of battery condition will be "Aman", and if PLN power on vending machine is “off”, then column from battery condition will be "Darurat".

In this study, the vending machine is equipped with an early warning system using SMS. Early warning system will be activated when PLN power source is off, so when the PLN power source is off, then the early warning system will send SMS to the owner that PLN power source off, and Battery will back up the power supply for several hours. SMS on this early warning system will be looks like Fig. 9.

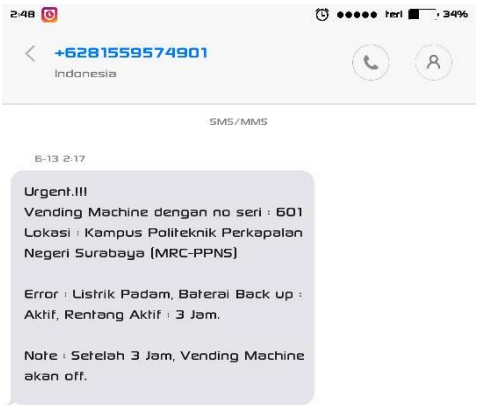

Fig. 9. SMS from Early Warning System

IV. CONCLUSION

From the tests result data, it can be seen that SVMc successfully done several transactions in normal condition TCASH. The SVMc online monitoring and EWS is also capable to send correct information to the owner in real time when the electricity is cut of. The information sent using Android and SMS. In other word, it can be said that SVMc has a big chance to challange for mass production.

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